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DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

RANGELAND MONITORING

TREND STUDIES

TECHNICAL REFERENCE 4400-4

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RANGELAND MONITORING - TREND STUDIES

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RANGELAND MONITORING - TREND STUDIES

1. TREND DATA.

Trend data are important in determining the effectiveness of on-the-ground management actions and evaluating progress toward meeting management objectives on rangeland administered by the Bureau of Land Management (BLM). Trend refers to the direction of change. It indicates whether the rangeland is moving toward or away from its potential or toward or away from specific management objectives. Trend of a rangeland area may be judged by noting changes in characteristics such as composition, density, cover, production, and frequency of the vegetation, and related parameters of other resources. Trend data are considered along with actual use, authorized use, estimated use, utilization, climate, and any other data available or necessary for allotment, wildlife habitat area, herd management area, watershed area, or other designated management area evaluations. Permittees, lessees, other rangeland users, and interested parties should be consulted and encouraged to participate in the collection and use of trend data. (See Sections 2.2 through 2.4, Technical Reference 4400-1.)

2. COLLECTING TREND DATA.

2.1 Frequency of Studies. Trend studies are conducted as frequently as needed to satisfy data requirements for allotment, wildlife habitat area, herd management area, watershed area, or other designated management area evaluations. They are generally conducted at periodic intervals in sequence with grazing treatments. For example, trend studies could be conducted once every three years on a three-pasture grazing system and once every five years on a five-pasture grazing system. Where studies are conducted only once during each grazing cycle, they should be conducted at the same point in each cycle so that the data will be comparable. Schedules for conducting trend studies are documented in monitoring plans or activity plans. (See Section 7, Technical Reference 4400-1.)

2.2 Timing of Studies. Trend studies should be started before initiating management under an activity plan (AMP, HMP, etc.) or changing management on an allotment, wildlife habitat area, herd management area, watershed area, or other designated management area. This is to ensure that there is a record of the resource situation prior to changes in management. Trend data should normally be collected after the growing season when the majority of the plants have reached maximum growth. However, certain plant communities and environmental influences may require that pictures be taken and measurements and/or estimates be recorded at different times during the growing season. In order to obtain the best data, trend studies should be conducted on ungrazed pastures. It is important that once the time for trend studies has been selected, that the follow-up studies in succeeding years be conducted at the same time (phenologically) during the growing season.

2.3 Documentation. Trend data are recorded on the appropriate forms. Forms for the trend study methods described in this Technical Reference are included in the Illustrations Section. Close-up and general view photographs should be used with all of the trend study methods. (See Section 3.4.) File the forms, photographs, and any other pertinent information in the allotment file or as otherwise prescribed. (See Section 6, Technical Reference 4400-1.)

3. KEY CONSIDERATIONS.

Consistency is important in the collection of trend data.

3.1 Plant Species Identification. The plant species must be properly identified when conducting trend studies in order for the data to be useful in allotment, wildlife habitat area, herd management area, watershed area, or other designated management area evaluations. In some cases, it may be helpful to include pressed plant specimens, photographs, or other aids used for species identification in the study file. If data are collected prior to positive species identification, examiners should collect plant specimens for later verification.

3.2 Plot Size and Shape. Various sizes and shapes of plots can be used to collect trend data; however, all plots used to collect a particular kind of data on a transect must be of the same size and shape.

3.3 Indicators of Trend. Changes in the following vegetation and soil characteristics are indications of trend: cover, plant vigor, reproduction, erosion conditions, litter accumulation, vegetation composition, production, frequency, density, form class (e.g. hedging), and age class. All of these indicators do not have to be measured to determine trend. Various combinations of these indicators are measured or estimated depending on the particular study method selected.

3.4 Photographs. Use close-up and/or general view photographs with all of the trend study methods. Comparing photographs of the same site taken over a period of years furnishes visual evidence of vegetation and soil changes. All photographs should be in color.

3.41 Identifying Photographs. Include the study number and other information pertinent to a study site on a Photo Identification Label. (See Illustrations 1 and 2.) Include the label in the photographs to ensure proper photo identification.

3.42 Close-up Photographs. Close-up photographs show the soil surface characteristics and the amount of ground surface covered by vegetation and litter. Close-up photographs are generally taken of permanently located photo plots.

a. The location of photo plots is determined at the time the studies are established. Document the location of photo plots on the Study Location and Documentation Data Form to expedite relocation. (See Illustration 3.)

b. Generally a 3- X 3-foot square frame is used for photo plots; however, a different size and shape frame may be used.

c. Angle iron stakes are driven into the ground at two diagonal corners of the frame to permanently mark a photo plot. (See Illustration 4.) Paint the stakes with bright-colored permanent spray paint (yellow or orange) to aid in relocation. Repaint these stakes when subsequent photographs are taken.

d. The Photo Identification Label is placed flat on the ground immediately adjacent to the photo plot frame. (See Illustration 2.)

e. The camera point, or the location from which the close-up photograph is taken, should be on the north side of the photo plot so that repeat photographs can be taken at any time during the day without casting a shadow across the plot.

f. To take the close-up photographs, stand over the photo plot with toes touching the edge of the frame. Include the photo label in the photograph. Use a 35-mm camera with a 28-mm wide-angle lens.

g. A step ladder is needed to take close-up photographs of photo plots larger than 3- X 3-foot.

3.43 General View Photographs. General view photographs present a broad view of a study site. These photographs are often helpful in relocating study sites.

a. If a transect method is used, general view photographs may be taken from either or both ends of the transect. The points from which these photographs are taken are determined at the time the studies are established. Document the location of these points on the Study Location Documentation Data Form to expedite relocation. (See Illustration 3.)

b. The Photo Identification Label is placed in an upright position so that it will appear in the foreground of the photograph. (See Illustration 2.)

c. To take general view photographs, stand at the selected points and include the photo label, a general view of the site, and some sky in the photographs.

d. A photograph of a study site taken from the nearest road at the time of establishment of the study facilitates relocation.

3.44 Repeat Photographs. When repeat photographs are taken, follow the same process used in taking the initial photographs. Include the same area and landmarks in the repeat general view photographs that were included in the initial photographs. Take repeat photographs at approximately the same time of year as the original photographs.

3.5 General Observations. General observations concerning the sites on which studies data are collected can be important in allotment, wildlife habitat area, herd management area, watershed area, or other designated management area evaluations. Such things as use by rodents, insect infestation, animal concentration, fire, vandalism, and other uses of the sites can have considerable impact on vegetation and soil resources. This information is recorded on the reverse side of the study method forms or on separate pages, as necessary. (See Section 2.3.)

4. TREND STUDY METHODS.

4.1 Selecting a Method. No single method of vegetation sampling is suitable for all vegetation types and management situations encountered on Western rangelands. (See Sections 1, 3, 5, and 7.33, Technical Reference 4400-1.) Selecting a sound sampling technique is critical to the success of a study. Monitoring methods should be sensitive to changes in the plant community, and should be unbiased, efficient, and cost-effective. Carefully consider the advantages and limitations of each method with respect to the type of vegetation on which the studies are to be conducted and the type of data needed to monitor trend. Measurement of more than one characteristic of the vegetation will provide a more complete picture of the nature of vegetation change. (See Illustration 5.) While it is important to choose an efficient and cost-effective method (in terms of both dollars and workmonths), sensitivity and unbiasedness should not be unduly compromised in the process.

4.2 Permanent vs. Temporary Transects and/or Plots. The location of the starting or beginning point of trend study transects is permanently marked on selected sites within key areas. Depending on the study method, the location of the sampling points and/or plots along the transect line may be permanently marked with a tape and/or frame, or they may be selected at a pacing interval, in which case they would not be permanently marked. Sampling points and/or plots along pace transects are temporary because the exact same spot will not be sampled on subsequent readings along that transect. In some cases it may be advantageous to use permanent transects to ensure that data are collected from the exact same spot each time. In other cases, samples collected anywhere along the same transect line may be adequate.

4.3 Combinations of Sampling Methods. Combinations of basic sampling methodologies may be used to collect the types of data that are needed. For example, a step-point transect or line intercept transect may be used in conjunction with the Photo Plot Method. Daubenmire cover data can be collected along a base line tape set out for another study method, such as the Quadrat Frequency Method. Density data can be collected with frames used to collect frequency and/or cover data.

4.4 Methods. In addition to the methods described in this Technical Reference, the Twig Length Measurement, Cole Browse, and Extensive Browse Methods described in Technical Reference 4400-3, may also be used for trend studies.

RANGELAND MONITORING - TREND STUDIES

4.41 PHOTO PLOT METHOD.

a. General Description. The Photo Plot Method includes taking a close-up photograph of either a 3- X 3-foot plot or a 5- X 5-foot plot and a general view photograph of the study site. In addition, measurements and/or estimates are made to provide quantitative data concerning vegetation characteristics that may or may not be seen in the photographs. The following indicators of trend are monitored with this method: (See Section 3.3.)

(1) Foliar and basal cover (including litter)

(2) Composition (by cover)

(3) Reproduction of key species

(4) Density

b. Areas of Use. This method has wide applicability and is suited for use with grasses, forbs, and shrubs.

c. Advantages and Limitations. This method provides both a photographic record and measurement or estimate of the vegetation cover and composition. Depending on the density of the vegetation, it may take considerable time to measure and estimate the vegetation on the plot. Limitations of this method are the extremely small area sampled, the difficulty in identifying seedlings, and the variation in the data collected among examiners.

d. Equipment.

(1) Study Location and Documentation Data Form (See Illustration 3.)

(2) Trend Study Data - Photo Plot Method Form (See Illustration 6.)

(3) Photo Identification Label (See Illustration 2.)

(4) Frame to delineate the 3- X 3-foot or 5- X 5-foot plots (See Illustrations 7 and 8.)

(5) Square-foot gridded frame with 16 equal divisions (See Illustration 7.)

(6) Stakes - 3/4- or 1-inch angle iron not less than 16 inches long

(7) Hammer

(8) Permanent yellow or orange spray paint

(9) Camera - 35-mm with a 28-mm wide-angle lens

(10) Exposure meter (if camera is not equipped with one)

(11) Film

(12) Tripod (optional)

(13) Small step ladder (for 5- X 5-foot photo plots)

(14) Black felt-tip pen

(15) Measuring tape calibrated in 10ths of inches

(16) Steel post

(17) Post driver

(18) Compass

e. Training. Examiners must be able to identify plant species. They must know how measurements and estimates on the plots are collected and recorded. The accuracy of the data depends on the training and ability of the examiners to make the measurements and estimates. (See Section 3, this Reference, and Section 4, Technical Reference 4400-1.)

f. Establishing Plots. Careful establishment of plots is a critical element in obtaining meaningful data. (See Sections 5.2 through 5.4, Technical Reference 4400-1.)

(1) Site Selection. Stratify the allotment, wildlife habitat area, herd management area, watershed area, or other designated management area; select the key area(s) and key species; and determine the number, size, and location of the plots. (See Section 5.1, Technical Reference 4400-1.)

(2) Number of Plots. Establish one plot on each key area; establish more if needed. (See Sections 1 and 5, Technical Reference 4400-1.)

(3) Plot Size and Shape. Use a 3- X 3-foot plot in herbaceous vegetation and a 5- X 5-foot plot in shrub vegetation. If the herbaceous vegetation is sparse, the 5- X 5-foot plot may be used.

(a) Plot Frame - 3- X 3-foot. Rods are used to divide the 3- X 3-foot frame into nine equal square-foot sections. A square-foot frame gridded into 16 equal units can be used to obtain more precise data. Each of these grid units represents 0.7 percent of the area of a 3- X 3-foot plot. (See Illustration 7).

(b) Plot Frame - 5- X 5-foot. The 5- X 5-foot frame is supported above the vegetation by six telescoping legs. A gridded overlay frame, 1-foot wide and 5-foot long, divides the plot frame into smaller units. The overlay frame is constructed of welding rod and is gridded into 1/16-square-foot units. The plot frame is marked at 1-foot intervals on two parallel sides so that the gridded overlay frame can be positioned at 1-foot intervals across the plot. (See Illustration 8.)

(4) Plot Location.

(a) Permanently mark plots with angle-iron stakes driven into the ground at two diagonal corners of the plots. (See Illustration 4).

(b) Paint the stakes with bright-colored permanent spray paint (yellow or orange) to aid in relocation. Repaint these stakes when subsequent readings are made.

(5) Reference Post or Point. Permanently mark the location of each plot by means of a reference post (steel post) placed about 100 feet from the plot. Record the bearing and distance from the post to the plot. An alternative is to select a reference point, such as a prominent natural or physical feature, and record the bearing and distance from that point to the plot. If a post is used, it should be tagged to indicate that it marks the location of a monitoring study established by the Bureau of Land Management and that it should not be disturbed.

(6) Plot Identification. Number plots for proper identification to ensure that the data collected can be positively associated with specific sites on the ground. (See Illustration 1.)

(7) Plot Documentation. Document the location, size, and other pertinent information concerning a plot on the Study Location and Documentation Data Form. (See Illustration 3, this Reference, and Section 6, Technical Reference 4400-1.) Plot the precise location of the photo plots on detailed maps and/or aerial photos.

g. Taking Photographs. Take close-up photographs of the plot, as well as the general view photographs, before making any measurements or estimates. The directions for taking photographs are described in Section 3.4.

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h. Sampling Process. Count seedlings and mature plants by species and determine vegetation cover and composition by measurement and/or estimation. (See Section 3.1.) Record the data on the Trend Study Data - Photo Plot Method Form. (See Illustration 6.) When repeat measurements and/or estimates are made, follow the same process used in making the initial measurements and/or estimates. In addition to collecting the specific studies data, general observations should be made of the study sites. (See Section 3.5.)

(1) Number of Plants. Count and record on the form the number of seedlings and mature perennial plants, by species, within the plot. In dense vegetation, the plants may be counted on a randomly-selected small portion of the plot and converted to the total for the plot. The form includes space for a plot diagram where the examiner can sketch in all the plants or just the key species.

(2) Measuring Cover. Record basal and foliar cover in square inches on the form. Measurements are made where the growth form is a bunch type and clearly defined, such as bluebunch wheatgrass (Agropyron spicatum) or Indian ricegrass (Oryzopsis hymenoides). Measure vegetation in its natural state, not "bunched" or "compressed." (See Illustration 9.) Most plant species grow in the form of an ellipse rather than a circle. Therefore, basal area measurements of bunchgrass and foliar cover measurements of forbs and shrubs will consist of two measurements--the long and short diameters. Area is calculated by using the formula, Area = πab, where a and b are lengths of major and minor radii.

(a) Grasses. Measure basal area of bunchgrasses to the nearest 1/10 inch at 1 inch above the soil surface. Measure any dead or vacant central portions of a grass clump and subtract from the total if the portion is larger than 10 percent of the plant basal area.

(b) Forbs and Shrubs. Measure foliar cover of forbs and shrubs, projected to the ground surface as viewed from directly above, if they are clearcut in outline. Subtract dead or vacant central portions exceeding 10 percent of the plant cover. For example, a shrub measures 14 X 20 inches but an area in the center, 5 X 8 inches, is "open." The area of the shrub is:

$$A = \pi ab - \pi a'b' = (3.14)(7)(10)-(3.14)(2.5)(4) = 188 \text{ square inches.}$$

(3) Estimating Cover. Estimates are made on litter and plants that are difficult to measure, i.e., creeping or decumbent forms. Estimations are more rapid than measurements but not as sensitive because small changes in plant size may not be readily detected.

(a) Making Estimates Using the 3- X 3-foot Plot. Place the square-foot gridded frame over each square foot of the plot. (See Illustration 7.) Observe the vegetation cover from directly above the grid and count the number of 1/16-square-foot units of basal or foliar cover by species. Do this for each species on the plot. Record the number of units of basal or foliar cover by species on the form. If the observed cover does not fill any specific 1/16-square-foot unit, estimate the percent of a unit that is filled. Estimate the amount of litter cover in the same manner.

(b) Making Estimates Using the 5- X 5-foot Plot. Place the 1- X 5-foot gridded frame over a 1- X 5-foot section of the plot frame. (See Illustration 8.) Observe the vegetation cover and count the number of 1/16-square-foot units of basal or foliar cover by species in the same manner as described for making estimates using the 3- X 3-foot plot. (See preceding section.) Advance the gridded frame a foot at a time until the plot has been covered. Litter cover and cover by understory species can be estimated with the 1-square-foot gridded frame if desired.

(c) Estimating Cover of Stoloniferous Grasses. Generally, the cover by stoloniferous grasses can be estimated because they form a dense closed sod cover. Determine basal ground cover, as viewed through the 1/16-square-foot units of the grid.

(d) Estimating Cover of Forbs and Shrubs. Record the foliar cover of forbs and shrubs as viewed through the small grids. Do not count grids filled with dead portions of the plants.

(4) Combining Measurements and Estimates. Measurements and estimates are used if both clearly defined and irregularly shaped plants occur in a plot. For example, a plot contains a very irregular-shaped shrub, two or three bunchgrasses, and a thin cover of rhizomatous grasses. Estimate the foliar cover of the shrub and the basal area of the rhizomatous grasses and measure the basal area of the bunchgrasses.

(a) Rhizomatous Grasses. Rhizomatous grasses are difficult to measure or estimate. Where only a few stems are present, count and record the number. Where the entire plot contains widely spaced stems, count the stems in randomly selected grids, and convert to total number for the plot. Count stems in at least 10 percent of the grids that contain the species. Convert these to basal area. Measure the area of 15 to 20 stems (or some other unit) and multiply by the total number. For example, if a plot contains 1,000 stems of western wheatgrass (Agropyron smithii) and 20 stems have an area of one square inch, the area of this species on the plot is 50 square inches.

(b) Annual Grasses. For annual grasses, use the same procedure used for rhizomatous grasses. (See preceding section.) Estimate, as nearly as possible, the basal cover of the plants and not the foliar cover.

i. Calculations. Calculate the trend index by totalling the following factors and record on the Trend Study Data - Photo Plot Method Form. (See Illustration 6.)

(1) Composition. The composition factor is the percentage that the key species make up of the total plant composition on the plot.

(2) Vegetation Cover. The vegetation cover factor is the percent ground cover provided by all live vegetation (basal cover of grasses and foliar cover of forbs and shrubs) on the plot.

(3) Seedlings. The seedlings factor is the total number of seedlings of the key species on the plot.

(4) Litter. The litter factor is the percentage of the plot area that is covered by litter.

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4.42 COMMUNITY STRUCTURE ANALYSIS (CSA) METHOD.

a. General Description. The Community Structure Analysis (CSA) Method assigns an "importance value" to each species to describe its status in the community. This value is based on relative cover, relative density, and relative frequency. A 100-point pace transect is run to collect the vegetation data. Close-up and general view photographs should be used with this method. The following indicators of trend are monitored with this method: (See Section 3.3.)

(1) Foliar cover (including litter)

(2) Density

(3) Frequency

(4) Composition by foliar cover and density

b. Areas of Use. This method is recommended for grass-shrub vegetation types.

c. Advantages and Limitations. The method is easy to use and interpret. Because the importance is based on "relative" rather than "absolute" values, it is less affected by estimator bias. The relative position of a plant species in the community is essentially undisturbed by year-to-year differences in rainfall, as density and frequency tend to compensate for fluctuations in production.

d. Equipment.

(1) Study Location and Documentation Data Form (See Illustration 3.)

(2) Trend Study Data - Community Structure Analysis Method--Foliar Cover Data Form (See Illustration 10.)

(3) Trend Study Data - Community Structure Anlaysis Method--Density and Frequency Data Form (See Illustration 11.)

(4) Trend Study Data - Community Structure Analysis Method--Summary Form (See Illustration 12.)

(5) Photo Identification Label (See Illustration 2.)

(6) Frame to delineate the 3- X 3-foot photo plots

(7) Stakes - 3/4- or 1-inch angle iron not less than 16 inches long

(8) Hammer

(9) Permanent yellow or orange spray paint

(10) Camera - 35-mm with a 28-mm wide-angle lens

(11) Exposure meter (if camera is not equipped with one)

(12) Film

(13) Tripod (optional)

(14) Black felt-tip pen

(15) Microplot frame - 5 X 10 centimeters divided into quarters

(16) Circular plot frame - 9.6 square feet or smaller if vegetation is dense

(17) Tally counter (optional)

(18) Compass

(19) Steel post

(20) Post driver

e. Training. The accuracy of the data depends on the training and ability of the examiners. (See Section 3, this Reference, and Section 4, Technical Reference 4400-1.)

(1) Examiners must be able to identify the plant species.

(2) Examiners must know how to collect foliar cover data.

(3) Examiners should be consistent in determining the number of individual plants. For most plant species, individuals are readily distinguished. However, most communities contain some species that reproduce vegetatively. Determination of what constitutes a plant unit in such cases is somewhat arbitrary. For rhizomatous grasses such as western wheatgrass (Agropyron smithii), each culm group can be visualized as an actual or potential plant unit, as can rooted stoloniferous units of such species as vine mesquite (Panicum obtusum). Mat or sod-forming plants such as blue grama (Bouteloua gracilis) or alkali sacaton (Sporobolus airoides) usually start growth as small, distinct clumps, but may spread to plants a yard or more in

diameter. As this occurs, they tend to fragment into more-or-less separate units, and it is these separate units that should be counted as actual or potential individuals.

(4) Examiners must be familiar with the operation of the camera equipment.

f. Establishing Transects. Careful establishment of transects is a critical element in obtaining meaningful data. (See Sections 5.2 through 5.4, Technical Reference 4400-1.)

(1) Site Selection. Stratify the allotment, wildlife habitat area, herd management area, watershed area, or other designated management area; select the key area(s) and key species; and determine the number, length, and location of the transects. (See Section 5.1, Technical Reference 4400-1.)

(2) Number of Transects. Establish one transect on each key area; establish more if needed. (See Sections 1 and 5, Technical Reference 4400-1.)

(3) Transect Layout.

(a) Drive an angle iron location stake into the ground to permanently mark the location of each transect. (See Illustration 13.)

(b) At the location stake, determine the transect bearing and select a prominent distant landmark such as a peak, rocky point, etc., that can be used as the transect bearing point. Drive an angle iron stake into the ground at a point 6 feet from the location stake along the transect bearing. (See Illustration 13.)

(c) Paint the transect location and transect bearing stakes with bright-colored permanent spray paint (yellow or orange) to aid in relocation. Repaint these stakes when subsequent readings are made.

(4) Reference Post or Point. Permanently mark the location of each transect by means of a reference post (steel post) placed about 100 feet from the transect location stake. Record the bearing and distance from the post to the transect location stake. An alternative is to select a reference point, such as a prominent natural or physical feature, and record the bearing and distance from that point to the transect location stake. If a post is used, it should be tagged to indicate that it marks the location of a monitoring study established by the Bureau of Land Management and that it should not be disturbed.

(5) Transect Identification. Number transects for proper identification to ensure that the data collected can be positively associated with specific sites on the ground. (See Illustration 1.)

(6) Transect Documentation. Document the location, starting point, bearing, sampling interval, and other pertinent information concerning a transect on the Study Location and Documentation Data Form. (See Illustration 3, this Reference, and Section 6, Technical Reference 4400-1.) Plot the precise location of the transects on detailed maps and/or aerial photos.

g. Taking Photographs. The directions for taking close-up and general view photographs are described in Section 3.4.

h. Sampling Process. The studies data are collected by species along a 100-point pace transect. (See Section 3.1.) Microplots are read at each point and a 9.6-square-foot, or other size, circular plot is read at each tenth microplot. (See Section 3.2.) Data are recorded on the Trend Study Data - Community Structure Analysis Method--Foliar Cover Data Form and the Trend Study Data - Community Structure Analysis Method--Density and Frequency Data Form. (See Illustrations 10 and 11.) When the transects are reread, follow the same process that was used when they were established. In addition to collecting the specific studies data, general observations should be made of the study sites. (See Section 3.5.)

(1) Collecting Cover Data.

(a) Beginning at one pace from the transect bearing stake, along the transect bearing, collect cover data with a 5- X 10-cm microplot frame at every pace (every alternate step), or other prescribed interval, along the transect for a total of 100 samples. Center the microplot frame in front of the toe. (See Illustration 13.)

(b) With each placement of the microplot frame, estimate the foliar coverage of each perennial plant species. Record the data by dot count tally, by species, by cover class, on the Trend Study Data - Community Structure Analysis Method--Foliar Cover Data Form. (See Illustration 10.) Foliar coverage data may also be collected for annual plant species. The cover classes are as follows:

Cover Class	Range of Coverage	Midpoint of Range
1	1-5%	2.5%
2	5-25%	15.0%
3	25-50%	37.5%
4	50-75%	62.5%
5	75-95%	85.0%
6	95-100%	97.5%

(c) Alternative cover classes can be used with this method. When transects are reread, use the same cover classes used when the studies were established. An example of ten cover classes is as follows:

Cover Class	Range of Coverage	Midpoint of Range
1	1 - 5%	2.5%
2	5 - 12.5%	8.75%
3	12.5 - 25%	18.75%
4	25 - 37.5%	31.25%
5	37.5 - 50%	43.75%
6	50 - 62.5%	56.25%
7	62.5 - 75%	68.75%
8	75 - 87.5%	81.25%
9	87.5 - 95%	91.25%
10	95 - 100%	97.5%

(d) Estimate the undisturbed foliar cover for grasses, forbs, and shrubs. Consider all individuals of a plant species in the microplot as a unit. All other kinds of plants are ignored as each plant species is considered. The plants do not have to be rooted in the plot.

(e) The 5- X 10-cm microplot frame is divided into fourths to assist in estimation.

(f) Overlapping foliar cover is included in the cover estimates by species; therefore, total cover may exceed 100 percent. Total cover may not reflect actual ground cover.

(g) Estimate and record the cover for litter (loose plant material or standing dead material) and rock (1/2 inch in diameter and larger).

(2) Collecting Density and Frequency Data.

(a) At each tenth microplot, collect density data with a 9.6-square-foot circular plot. Center the circular plot frame in front of the toe. (See Illustration 13.) A total of ten samples is collected. Depending on the density of the vegetation, a smaller size circular plot may be used. Record the number of plants by species for all perennial grasses, forbs, and shrubs on the Trend Study Data - Community Structure Analysis Method--Density and Frequency Data Form. (See Illustration 11.) Density and frequency data may also be collected for annual plant species.

(b) Count by species all plants rooted within the plot. The majority of the base of the plant must be in the plot to be counted.

i. Calculations.

(1) Cover. Calculate the percent cover by species as follows:

(a) Convert the dot count for each species in each cover class to the number of plots that included that species in that cover class.

(b) Multiply this value times the midpoint of the appropriate cover class.

(c) Total the products for all cover classes by species.

(d) Divide the sum by the total number of microplots sampled on the transect (usually 100).

(e) Record the percent cover by species on the Trend Study Data - Community Structure Analysis Method--Foliar Cover Data Form and on the Trend Study Data - Community Structure Analysis Method--Summary Form. (See Illustrations 10 and 12.)

(2) Density. Calculate the density for each plant species by adding the number of plants of the species counted in the 10 circular plots. Record the totals on the Trend Study Data - Community Structure Analysis Method--Density and Frequency Data Form and on the Trend Study Data - Community Structure Analysis Method--Summary Form. (See Illustrations 11 and 12.)

(3) Frequency. Calculate the percent frequency for each plant species by dividing the number of circular plots in which the species occurred by the total number of circular plots sampled (usually 10) and multiplying the value by 100. Record the percent frequency on the Trend Study Data - Community Structure Analysis Method--Density and Frequency Data Form and on the Trend Study Data - Community Structure Analysis Method--Summary Form. (See Illustrations 11 and 12.)

(4) Importance Value. The importance value of a species is a composite score of the relative cover, relative density, and relative frequency; it represents the relative importance of that species in the plant community. Calculate the relative values by dividing the individual species values for cover, density, and frequency, by the total values for these data categories for all species. Plant species can be ranked by importance value. The total community has an importance value of 3.00. The importance value is calculated and recorded on the Trend Study Data - Community Structure Analysis Method--Summary Form. The percent plant cover, litter cover, rock cover, and bare ground are also recorded on this form. (See Illustration 12.)

RANGELAND MONITORING - TREND STUDIES

4.43 DAUBENMIRE METHOD

a. General Description. The Daubenmire Method consists of systematically placing a 20- X 50-cm plot frame along a tape on a permanently located transect. Close-up and general view photographs should be used with this method. The following indicators of trend are monitored with this method: (See Section 3.3)

(1) Canopy cover

(2) Frequency

(3) Composition by canopy cover

b. Areas of Use. This method is applicable to a wide variety of vegetation types as long as the plants do not exceed waist height.

c. Advantages and Limitations. This method is relatively simple and rapid to use. With adequate training, closely reproducible results are usually obtained with 40 to 50 plots per transect. A limitation of this method is that there can be large changes in canopy cover of herbaceous species between years because of climatic conditions with no relationship to the effects of management.

d. Equipment.

(1) Study Location and Documentation Data Form (See Illustration 3.)

(2) Trend Study Data - Daubenmire Method--Six Cover Classes Form (See Illustration 14.)

(3) Trend Study Data - Daubenmire Method--Ten Cover Classes Form (See Illustration 15.)

(4) Photo Identification Label (See Illustration 2.)

(5) Frame to delineate the 3- X 3-foot photo plots

(6) Stakes - 3/4- or 1-inch angle iron not less than 16 inches long

(7) Hammer

(8) Permanent yellow or orange spray paint

(9) Camera - 35-mm with a 28-mm wide-angle lens

(10) Exposure meter (if camera is not equipped with one)

(11) Film

(12) Tripod (optional)

(13) Black felt-tip pen

(14) Stakes which are stout enough to have a tape stretched between them

(15) Tape - 100- or 200-foot

(16) Steel pins (reinforcement bar) for marking zero, mid, and end points of the transect

(17) Frame to delineate the 20- X 50-cm plots (See Illustration 16.)

(18) Compass

(19) Steel post

(20) Post driver

e. Training. The accuracy of the data depends on the training and ability of the examiners. Examiners must be able to identify the plant species. They must receive adequate and consistent training in laying out transects and making canopy coverage estimates using the frame. Examiners must also be familiar with the operation of the camera equipment. (See Section 3, this Reference, and Section 4, Technical Reference 4400-1.)

f. Establishing Transects. Careful establishment of transects is a critical element in obtaining meaningful data. See Sections 5.2 through 5.4, Technical Reference 4400-1.)

(1) Site Selection. Stratify the allotment, wildlife habitat area, herd management area, watershed area, or other designated management area; select the key area(s) and key species; and determine the number, length, and location of the transects. (See Section 5.1, Technical Reference 4400-1.)

(2) Number of Transects. Establish one transect on each key area; establish more if needed. (See Sections 1 and 5, Technical Reference 4400-1.)

(3) Transect Layout. Transects should traverse an area of maximum vegetation homogeneity.

(a) Permanently mark the location of transects with transect location and transect bearing stakes. These stakes are driven into the ground beyond each end of the transect. The distance between the stakes is dependent on the length of the transect. The transect location stake is placed beyond the zero point of the transect. After determining the bearing of the transect, place the transect bearing stake beyond the end point of the transect. The height of the stakes is dependent on the height of the vegetation. (See Illustration 17.)

(b) Paint the transect location and transect bearing stakes with bright-colored permanent spray paint (yellow or orange) to aid in relocation. Repaint these stakes when subsequent readings are made.

(c) Align the tape (100- or 200-foot) in a straight line by stretching it between the transect location and transect bearing stakes. Do not allow vegetation to deflect the alignment of the tape. A spring and pulley may be useful to maintain a straight line. The tape should be aligned as close to the ground as possible.

(d) Drive steel pins almost to the ground surface at the zero point on the tape and at the end of the transect. A pin may also be driven into the ground at the midpoint of the transect. (See Illustration 17.)

(4) Refererence Post or Point. Permanently mark the location of each transect by means of a reference post (steel post) placed about 100 feet from the transect location stake. Record the bearing and distance from the post to the transect location stake. An alternative is to select a reference point, such as a prominent natural or physical feature, and record the bearing and distance from that point to the transect location stake. If a post is used, it should be tagged to indicate that it marks the location of a monitoring study established by the Bureau of Land Management and that is should not be disturbed.

(5) Transect Identification. Number transects for proper identifiction to ensure that the data collected can be positively associated with specific sites on the ground. (See Illustration 1.)

(6) Transect Documentation. Document the location, length, bearing, sampling intensity, number of samples, edge of tape used, number of coverage classes, and other pertinent information concerning a transect on the Study Location and Documentation Data Form. (See Illustration 3, this Reference, and Section 6, Technical Reference 4400-1.) Plot the precise location of the transects on detailed maps and/or aerial photos.

g. Taking Photographs. The directions for taking close-up and general view photographs are described in Section 3.4.

h. Sampling Process. In addition to collecting the specific studies data, general observations should be made of the study sites. (See Section 3.5.)

(1) Determining Number of Cover Classes. Determine whether the "six" or the "ten" cover classes better satisfy the objective of the study. (See Section 3.2.) When transects are reread, use the same cover classes that were used when the study was established.

(a) Six Cover Classes. Daubenmire's original description of the methodology characterized six separate cover classes (Daubenmire 1959). The cover classes are:

Cover Class	Range of Coverage	Midpoint of Range
1	0 - 5%	2.5%
2	5 - 25%	15%
3	25 - 50%	37.5%
4	50 - 75%	62.5%
5	75 - 95%	85%
6	95 - 100%	97.5%

(b) Ten Cover Classes. Where narrower and more numerous classes are preferred, use ten cover classes. The cover classes are:

Cover Class	Range of Coverage	Midpoint of Range
1	0 - 5%	2.5%
2	5 - 12.5%	8.75%
3	12.5 - 25%	18.75%
4	25 - 37.5%	31.25%
5	37.5 - 50%	43.75%
6	50 - 62.5%	56.25%
7	62.5 - 75%	68.75%
8	75 - 87.5%	81.25%
9	87.5 - 95%	91.25%
10	95 - 100%	97.5%

(2) Collecting Cover Data. As the plot frame is placed along the tape at the specified intervals, estimate the canopy coverage of each plant species. Record the data by dot count tally, by species, by cover class, on the Trend Study Data - Daubenmire Method--Six Cover Classes Form or on the Trend Study Data - Daubenmire Method--Ten Cover Classes Form. (See Illustrations 14 and 15.) Canopy coverage estimates can be made for both perennial and annual plant species. (See Section 3.1.) A minimum of 40 plots should be read on each transect.

(a) Observe the plot frame from directly above and estimate the cover class for all individuals of a plant species in the plot as a unit. All other kinds of plants are ignored as each plant species is considered. (See Illustration 16.)

(b) Imagine a line drawn about the leaf tips of the undisturbed canopies (ignoring inflorescences) and project these polygonal images onto the ground. This projection is considered "canopy coverage." Decide which of the classes the canopy coverage of the species falls into and record on the form by dot count.

(c) Canopies extending over the plot are estimated even if the plants are not rooted in the plot.

(d) Accidents of foliage dispersal within the projected canopy outline are ignored.

(e) Collect the data at a time of maximum growth of the key species.

(f) For tiny annuals, it is helpful to estimate the number of individuals that would be required to fill 5% of the frame (the 71- X 71-mm area). A quick estimate of the numbers of individuals in each frame will then provide an estimate as to whether the aggregate coverage falls in Class 1 or 2, etc.

(g) Overlapping canopy cover is included in the cover estimates by species; therefore, total cover may exceed 100 percent. Total cover may not reflect actual ground cover.

i. Calculations. Make the calculations and record the results in the appropriate columns on the Trend Study Data - Daubenmire Method--Six Cover Classes Form or on the Trend Study Data - Daubenmire Method--Ten Cover Classes Form. (See Illustrations 14 and 15.)

(1) Canopy Coverage. Calculate the percent canopy coverage by species as follows:

(a) Convert the dot count for each species in each cover class to the number of plots that included that species in that cover class.

(b) Multiply this value times the midpoint of the appropriate cover class.

(c) Total the products for all cover classes by species.

(d) Divide the sum by the total number of plots sampled on the transect.

(e) Record the percent coverage by species on the form.

(2) Frequency. Calculate the percent frequency for each plant species by dividing the number of occurrences of a plant species (the number of plots in which a plant species was observed) by the total number of plots sampled along the transect. Multiply the resulting value by 100. Record the percent frequency on the form.

(3) Species Composition. Under this method, species composition is based on the canopy coverage of the various species. It is determined by dividing the canopy coverage of each plant species by the total canopy coverage of all plant species. Record the percent composition on the form.

RANGELAND MONITORING - TREND STUDIES

4.44 PACE FREQUENCY METHOD.

a. General Description. The Pace Frequency Method consists of observing plots along four parallel transects with 50 plots systematically located at one-pace intervals along each transect. Close-up and general view photographs should be used with this method. The following indicators of trend are monitored with this method: (See Section 3.3.)

(1) Frequency

(2) Basal cover and general cover categories (including litter)

b. Areas of Use. This method is applicable to a wide variety of vegetation types and is suited for use with grasses, forbs, and shrubs.

c. Advantages and Limitations. Frequency indexes the uniformity of distribution and relative abundance of each plant species within a community. The only decisions that have to be made in the collection of frequency data are plant species identification and whether or not a plant of the listed species occurs within a plot. The method encourages consistent, rapid, and accurate observations while minimizing bias among different examiners. Cover data can also be collected with this method.

d. Equipment.

(1) Study Location and Documentation Data Form (See Illustration 3.)

(2) Trend Study Data - Pace Frequency Method Form (See Illustration 18.)

(3) Photo Identification Label (See Illustration 2.)

(4) Frame to delineate the 3- X 3-foot photo plots

(5) Stakes - 3/4- or 1-inch angle iron not less than 16 inches long

(6) Hammer

(7) Permanent yellow or orange spray paint

(8) Camera - 35-mm with a 28-mm wide-angle lens

(9) Exposure meter (if camera is not equipped with one)

(10) Film

(11) Tripod (optional)

(12) Black felt-tip pen

(13) Plot frame - 40- X 40-cm (See Illustration 19.)

(14) Tally counter (optional)

(15) Compass

(16) Steel post

(17) Post driver

e. Training. A minimum amount of training is needed for this method. Examiners must be able to identify the plant species and be able to tell whether or not a species occurs, according to study specifications, within a plot. Examiners must be familiar with the cover categories and how to collect cover data using the prong on the plot frame. They must also be familiar with the operation of the camera equipment. (See Section 3, this Reference, and Section 4, Technical Reference 4400-1.)

f. Establishing Studies. Careful establishment of studies is a critical element in obtaining meaningful data. (See Sections 5.2 through 5.4, Technical Reference 4400-1.)

(1) Site Selection. Stratify the allotment, wildlife habitat area herd management area, watershed area, or other designated management area; select the key area(s) and key species; and determine the number and location of the pace frequency studies. (See Section 5.1, Technical Reference 4400-1.)

(2) Number of Studies. Establish one pace frequency study on each key area; establish more if needed. (See Sections 1 and 5, Technical Reference 4400-1.)

(3) Study Layout.

(a) Drive an angle iron location stake into the ground to permanently mark the location of each study. (See Illustration 20.)

(b) Paint the study location stake with bright-colored permanent spray paint (yellow or orange) to aid in relocation. Repaint this stake when subsequent readings are made.

(c) Four parallel transects are offset from the study location stake, two to the right and two to the left. The suggested distance between the location stake and transects 1 and 3 and between each pair of transects is 5 paces, however, this distance may vary depending on the site. The locations of these transects are not permanently marked. (See Illustration 20.)

i. Transect 1. The first transect is offset five paces to the right of the location stake.

ii. Transect 2. The second transect is offset five paces to the right of and parallel to Transect 1.

iii. Transect 3. The third transect is offset five paces to the left of the location stake and parallel to Transect 1.

iv. Transect 4. The fourth transect is offset five paces to the left of and parallel to Transect 3.

(d) At the beginning of Transect 1, determine the transect bearing and select a prominent distant landmark such as a peak, rocky point, etc., that can be used as the transect bearing point.

(4) Reference Post or Point. Permanently mark the location of each study by means of a reference post (steel post) placed about 100 feet from the study location stake. Record the bearing and distance from the post to the study location stake. An alternative is to select a reference point, such as a prominent natural or physical feature, and record the bearing and distance from that point to the study location stake. If a post is used, it should be tagged to indicate that it marks the location of a monitoing study established by the Bureau of Land Management and that it should not be disturbed.

(5) Study Identification. Number studies for proper identification to ensure that the data collected can be positively associated with specific sites on the ground. (See Illustration 1.)

(6) Study Documentation. Document the location, starting point, bearing, distance between transects, sampling interval, plot frame size, and other pertinent information concerning a study on the Study Location and Documentation Data Form. (See Illustration 3, this Reference, and Section 6, Technical Reference 4400-1.) Plot the precise location of the studies on detailed maps and/or aerial photos.

g. Taking Photographs. The directions for taking close-up and general view photographs are described in Section 3.4.

h. Sampling Process. In addition to collecting the specific studies data, general observations should be made of the study sites. (See Section 3.5.)

(1) Selecting Plot Size. The selection of plot size is important and is dependent on the characteristics of the vegetation to be sampled. (See Section 3.2.)

(a) As a rule of thumb, it is expected that all frequency percentages for important species should fall between 10 and 90 percent or if possible, between 20 and 80 percent. This will provide the greatest possible chance for detecting an important trend for a species when the study is read again. Use a frame size that will produce frequencies falling in this range for the greatest number of species possible.

(b) A 40- X 40-cm plot has been found to be adequate for the desert rangelands of southern Arizona. Use the 40- X 40-cm plot frame as a base from which to determine the proper size plot that is needed in an area. (See Illustration 19.)

(c) Use a plot frame which is light weight but sturdy. It should be open on one side to facilitate proper placement.

(d) Use the same size plot throughout a transect and for rereading the transect.

(2) Running the Transects. Studies data are collected along four fifty-pace transects. (See Illustration 20.) A plot is read at each pace for a total of 200 plots (50 plots per transect). To lengthen the transects, pace off some desired distance (5 paces, 20 paces, etc.) between plots.

(a) Transect 1. Beginning at a point 5 paces to the right of the location stake, read the plots along Transect 1 at one-pace intervals along the transect bearing.

(b) Transect 2. Beginning at a point five paces to the right of Transect 1, proceed in the reverse direction and parallel to Transect 1 to a point offset ten paces to the right of the location stake. Read the plots along Transect 2 at one-pace intervals.

(c) Transect 3. Beginning at a point five paces to the left of the location stake, read the plots along Transect 3 at a one-pace intervals along a line ten paces to the left and parallel to Transect 1.

(d) Transect 4. Beginning at a point five paces to the left of Transect 3, proceed in the reverse direction and parallel to Transect 3 to a point offset ten paces to the left of the location stake. Read the plots along Transect 4 at one-pace intervals.

(3) Placing the Plot Frame. At each pace or other selected interval, along the transect, center the plot frame directly in front of the toe.

(4) Collecting Cover Data. Use the prong welded to the plot frame just to the front of the handle for collecting cover data. (See Illustration 19.) Record, by dot count tally, by transect, the cover category that is directly in front of the prong. The cover categories are bare ground (rock less than 1/2 inch in diameter is tallied as bare ground), persistent litter, non-persistent litter, rock (1/2 inch and larger), and basal hits on live vegetation. Record the data on the Trend Study Data - Pace Frequency Method Form. (See Illustration 18.)

(5) Collecting Frequency Data. Collect frequency data for all plant species. (See Section 3.1.) Record the data by dot count tally, by species, by transect, on the Trend Study Data - Pace Frequency Method Form. (See Illustration 18.) Only one tally is made regardless of the number of individual plants of a species that occurs within a plot.

(a) Herbaceous plants (grasses and forbs) must be rooted in the plot to be counted.

(b) Trees and shrubs (including half shrubs) are counted if rooted in the plot or if the canopy of these plants overhangs the plot. In some cases, it may be preferable to count trees and shrubs only if they are rooted in the plot.

(c) Annual plants are counted whether green or dried.

(d) Specimens of the plants which are unknown should be collected and marked for later identification.

(e) An alternative method for recording frequency data is explained in Illustration 33.

i. Calculations. Make the calculations and record the results in the appropriate columns on the Trend Study Data - Pace Frequency Method Form. (See Illustration 18.)

(1) Cover. Total the cover hits by category. Calculate the percent cover by category by dividing the total number of hits for that category by the total number of plots sampled along the transect and multiplying the value by 100. Record the percent cover on the form. The total of the percent cover for all cover categories equals 100 percent.

(2) Frequency. Total the frequency hits by species. Calculate the percent frequency for each plant species by dividing the total number of hits for that species by the total number of plots sampled along the transect and mulitplying the value by 100. Record the percent frequency on the form.

4.45 QUADRAT FREQUENCY METHOD.

a. General Description. The Quadrat Frequency Method consists of the observation of 10 (or more) quadrats along 10 or 20 transects randomly selected and run perpendicularly to a 100-foot baseline tape. Close-up and general view photographs should be used with this method. The following indicators of trend are monitored with this method: (See Section 3.3.)

(1) Frequency

(2) Basal cover and general cover categories (including litter)

(3) Reproduction of key species (if seedling frequency data are collected)

b. Areas of Use. This method is applicable to a wide variety of vegetation types and is suited for use with grasses, forbs, and shrubs.

c. Advantages and Limitations.

(1). Frequency sampling is simple to perform and easy to duplicate from year to year by the same or different examiners. Human decision is limited to identifying the plant species and determining whether or not plants of the listed species are rooted within the quadrats or whether or not plants of the listed tree or shrub species overhang the quadrats (presence or absence). The method encourages consistent and accurate observations while minimizing bias among different examiners.

(2) Varying amounts of cover data, in addition to frequency data, can be collected with this method.

d. Equipment.

(1) Study Location and Documentation Data Form (See Illustration 3.)

(2) Trend Study Data - Quadrat Frequency Method Form (See Illustration 21.)

(3) Photo Identification Label (See Illustration 2.)

(4) Frame to delineate the 3- X 3-foot photo plots

(5) Stakes - 3/4- or 1-inch angle iron not less than 16 inches long

(6) Hammer

(7) Permanent yellow or orange spray paint

(8) Camera - 35-mm with a 28-mm wide-angle lens

(9) Exposure meter (if camera is not equipped with one)

(10) Film

(11) Tripod (optional)

(12) Black felt-tip pen

(13) Stakes which are stout enough to have a tape stretched between them

(14) Steel tape - 100-foot

(15) Two small "C" clamps

(16) Set of quadrat frames (See Illustration 22.)

(17) Tally counter (optional)

(18) Compass

(19) Steel post

(20) Post driver

e. Training. A minimum amount of training is needed for this method. The examiners must be able to identify the plant species and be able to tell whether or not a species occurs, according to study specifications, within a quadrat. Examiners must be familiar with the cover categories and how to collect cover data using the tines on the quadrat frames. They must also be familiar with the operation of the camera equipment. (See Section 3, this Reference, and Section 4, Technical Reference 4400-1.)

f. Establishing Studies. Careful establishment of studies is a critical element in obtaining meaningful data. (See Sections 5.2 through 5.4, Technical Reference 4400-1.)

(1) Site Selection. Stratify the allotment, wildlife habitat area, herd management area, watershed area, or other designated management area; select the key area(s) and key species; and determine the number and location of the quadrat frequency studies. (See Section 5.1, Technical Reference 4400-1.)

(2) Number of Studies. Establish one quadrat frequency study on each key area; establish more if needed. (See Sections 1 and 5, Technical Reference 4400-1.)

(3) Number of Transects and Quadrats. Evaluate the rangeland plant communities where studies will be located and determine the number of transects and quadrats needed. The objective is to collect the best possible sample for the greatest number of species in any plant community. Some examples of the number of transects and quadrats recommended for several rangeland plant communities in Nevada are shown in Illustration 23.

(a) Number of Transects. Either 10 or 20 transects are run perpendicularly to the baseline for each study depending on the intensity of sample needed. (See Illustration 24.) The number of transects depends on such things as the homogeneity of the vegetation, values or "special values" for the area, and other considerations regarding the similarity or uniqueness of the plant communities.

(b) Number of Quadrats per Transect. Transects consist of groups of quadrats placed at specified intervals along a belt. (See Illustration 24.) Quadrats may be contiguous except where the points of both outside tines of the frames are used to collect cover data. (See Sections 4.45h(2) and (3).) Depending on the intensity of the sampling, 10 to 20 or more quadrats are located and read along each belt transect. (Increasing the number of quadrats to 30 or 40 per transect can greatly improve precision for minimal extra time expense.)

(4) Study Layout.

(a) Baseline.

i. Permanently locate the baseline by means of two stakes placed 100 feet apart. (See Illustration 24.) Stretch a 100-foot tape between the stakes as close to the ground as possible. Secure the tape to these stakes with "C" clamps. Align the zero point on the tape with the stake which is the beginning point of the baseline.

ii. Paint the stakes with bright-colored permanent spray paint (yellow or orange) to aid in relocation. Repaint these stakes when subsequent readings are made.

(b) Transects. The transects are run perpendicularly to the baseline. Each transect originates at a randomly selected foot mark along the baseline. The randomization is restricted so that half of the transects are randomized on each side of the 50-foot mark. (See Illustration 24.)

i. An example of 10 and 20 random numbers and directions are as follows:

Ten Random Foot Marks			
1.	2R	6.	52L
2.	17L	7.	61R
3.	25L	8.	69R
4.	37R	9.	80R
5.	42L	10.	85R

Twenty Random Foot Marks			
1.	2R	11.	52L
2.	7L	12.	54L
3.	17L	13.	61R
4.	20L	14.	62R
5.	25L	15.	69R
6.	29R	16.	77R
7.	37R	17.	80R
8.	40L	18.	81L
9.	42L	19.	85R
10.	45R	20.	98L

R = Right side of tape.
L = Left side of tape

ii. Transects may originate from alternating intervals of five or ten feet (running right and then left of the baseline) along the baseline.

(5) Reference Post or Point. Permanently mark the location of each study by means of a reference post (steel post) placed about 100 feet from the baseline beginning point stake. Record the bearing and distance from the post to the baseline beginning point stake. An alternative is to select a reference point, such as a prominent natural or physical feature, and record the bearing and distance from that point to the baseline beginning point stake. If a post is used, it should be tagged to indicate that it marks the location of a monitoring study established by the Bureau of Land Management and that it should not be disturbed.

(6) Study Identification. Number studies for proper identification to ensure that the data collected can be positively associated with specific sites on the ground. (See Illustration 1.)

(7) Study Documentation. Document the location of the baseline, bearing, number of transects, transect locations along the baseline, number of quadrats per transect, frame size(s), number of cover points per quadrat, and other pertinent information concerning a study on the Study Location and Documentation Data Form. (See Illustration 3, this Reference, and Section 6, Technical Reference 4400-1.) Plot the precise location of the studies on detailed maps and/or aerial photos.

g. Taking Photographs. The directions for taking close-up and general view photographs are described in Section 3.4.

h. Sampling Process. In addition to collecting the specific studies data, general observations should be made of the study sites. (See Section 3.5.)

(1) Selecting Quadrat Size. The selection of quadrat size is important and is dependent on the characteristics of the vegetation to be sampled. (See Section 3.2.)

(a) As a rule of thumb, it is expected that all frequency percentages for important species should fall between 10 and 90 percent or if possible, between 20 and 80 percent. This will provide the greatest possible chance for detecting an important trend for a species when the study is read again. Use a quadrat size that will produce frequencies falling in this range for the greatest number of species possible.

(b) Determine the proper size quadrat(s) to use by doing preliminary sampling with different size frames. (See Illustration 22.) Frame size recommendations for several rangeland plant communities in Nevada are shown in Illustration 23.

(c) Use the same size quadrat thoughout a study and for re-reading the study. If frequencies approach the extremes of either 0 or 100 percent, it may be necessary to change the quadrat size.

(2) Running the Transects.

(a) Start each transect by placing the rear corner of the quadrat frame at the selected foot mark along the baseline tape.

(b) Place the quadrat frame at the designated interval in a line (belt) perpendicular to the baseline until the specified number of quadrats have been read. (See Illustration 24.)

(c) The quadrats may be placed contiguously or at a specified interval. The interval is either estimated, or a rapid measurement method, such as the width of the frame, or segment of the frame, is used to measure the interval.

(d) When a transect is completed, move to the next selected foot mark on the baseline tape and run the next transect.

(3) Collecting Cover Data. Use the points on the four corners of the quadrat frame and the point on the center tine to collect cover data. (See Illustration 22.)

(a) With each placement of the frame, record by dot count tally, by transect, the cover category that is directly in front of each point. The cover categories are bare ground (rock less than 1/2 inch in diameter is tallied as bare ground), persistent litter, non-persistent litter, rock (1/2 inch and larger), and basal hits on live vegetation. Record the data on the Trend Study Data - Quadrat Frequency Method Form. (See Illustration 21.)

(b) If less cover data are desired, read fewer points on the frame. If more cover data are desired, read more points on the frame.

(c) Read the same points on the frame and the same number of points at each placement of the frame throughout a study and when rereading that study.

(4) Collecting Frequency Data. Collect frequency data for all plant species. (See Section 3.1.) Record the data by dot count tally, by species, by transect, on the Trend Study Data - Quadrat Frequency Method Form. (See Illustration 21.) Only one tally is made regardless of the number of individual plants of a species that occurs within a quadrat.

(a) Herbaceous plants (grasses and forbs) must be rooted in the quadrat to be counted.

(b) Trees and shrubs (including half shrubs) are counted if rooted in the quadrat or if the canopy of these plants overhangs the quadrat. In some cases, it may be preferable to count trees and shrubs only if they are rooted in the quadrat.

(c) Annual plants are counted whether green or dried.

(d) Specimens of the plants which are unknown should be collected and marked for later identification.

(e) Frequency occurrence of seedlings by plant species may be tallied.

(f) An alternative method for recording frequency data is explained in Illustration 33.

i. Calculations. Make the calculations and record the results in the appropriate columns on the Trend Study Data - Quadrat Frequency Method Form. (See Illustration 21.)

(1) Cover. The percent cover by cover category, e.g., persistent litter, can be calculated for each transect and/or for the total of all transects.

(a) Cover For Each Transect. On a ten quadrat transect where five cover readings are made with each placement of the frame, calculate the percent cover for each cover category by multiplying the number of hits in each category by two. If there are 20 quadrats in the transect, the percent cover by cover category is equal to the number of hits for that category. Where less than five cover readings are made with each placement of the frame, calculate the percent cover for each cover category by dividing the number of hits in each category by the total number of cover readings for the transect. The percent cover may be entered in the cover category block by transect on the form.

(b) Cover For Total of All Transects. Calculate the percent cover by cover category for the total of all transects by adding the hits by category for all transects and dividing the total by the total number of cover readings for the study. Record the percent cover on the form.

(2) Frequency. The percent frequency by species can be calculated for each transect and/or for the total of all transects.

(a) Frequency For Each Transect. Calculate the percent frequency of a plant species on a transect by multiplying the number of hits, or occurrences, by 10, if there are 10 quadrats, or by 5, if there are 20 quadrats in the transect. Record the percent frequency in the species block by transect on the form.

(b) Frequency For Total of All Transects. Calculate the percent frequency of a plant species for the total of all transects by adding the hits, or occurrences, for a species on all transects, dividing the total by the total number of quadrats sampled in the study, and multiplying the value by 100. Record the percent frequency on the form.

4.46 NESTED FREQUENCY METHOD.

a. General Description. The Nested Frequency Method consists of observing nested plots of various sizes along pace or belt transects. The frame is constructed such that successively smaller plots are included inside the next larger plot. Close-up and general view photographs should be used with this method. The indicator of trend monitored with this method is frequency. (See Section 3.3.)

b. Areas of Use. This method is applicable to a wide variety of vegetation types and is suited for use with grasses, forbs, and shrubs.

c. Advantages and Limitations.

(1) Frequency sampling is simple to perform and easy to duplicate from year to year by the same or different examiners. It is appealing because it is objective and rapid. The only decisions that have to be made in the collection of frequency data are plant species identification and whether or not a plant of the listed species occurs within a plot. The method encourages consistent, rapid, and accurate observations while minimizing bias among different examiners. Much data can be obtained for many species within a short period of sampling time.

(2) Frequency data can be collected in different-sized plots with each placement of the nested frame. When a plant of a particular species occurs within a plot, it also occurs in all of the successively larger plots. Frequency of occurrence for various size plots can be analyzed even though frequency is recorded for only one size plot. This eliminates problems with comparing frequency data from different plot sizes. Use of the nested plot configuration improves the chance of selecting a proper size plot for frequency sampling.

d. Equipment.

(1) Study Location and Documentation Data Form (See Illustration 3.)

(2) Trend Study Data - Nested Frequency Method--Four Transects Form (See Illustration 25.)

(3) Trend Study Data - Nested Frequency Method--Four Transect Summary Form (See Illustration 26.)

(4) Trend Study Data - Nested Frequency Method--Ten Transects Form (See Illustration 27.)

(5) Trend Study Data - Nested Frequency Method--Ten Transect Summary Form (See Illustration 28.)

(6) Photo Identification Label (See Illustration 2.)

(7) Frame to delineate the 3- X 3-foot photo plots

(8) Stakes - 3/4- or 1-inch angle iron not less than 16 inches long

(9) Hammer

(10) Permanent yellow or orange spray paint

(11) Camera - 35-mm with a 28-mm wide-angle lens

(12) Exposure meter (if camera is not equipped with one)

(13) Film

(14) Tripod (optional)

(15) Black felt tip pen

(16) Nested frequency plot frame (See Illustration 29.)

(17) Tally counter (optional)

(18) Compass

(19) Steel post

(20) Post driver

(21) Other equipment which may be needed depending on the study layout are listed below: (See Section 4.46f(3).)

(a) Stakes which are stout enough to have a tape stretched between them

(b) Steel tape - 100-foot

(c) Two small "C" clamps

e. Training. The accuracy of the data depends on the training and ability of the examiners. Examiners must be able to identify plant species and be able to tell whether or not a species occurs, according to study specifications, within a plot. They must also be familiar with the operation of the camera equipment. (See Section 3, this Reference, and Section 4, Technical Reference 4400-1.)

f. Establishing Studies. Careful establishment of studies is a critical element in obtaining meaningful data. See Sections 5.2 through 5.4, Technical Reference 4400-1.)

(1) Site Selection. Stratify the allotment, wildlife habitat area, herd management area, watershed area, or other designated management area; select the key area(s) and key species; and determine the number and location of the nested frequency studies. (See Section 5.1, Technical Reference 4400-1.)

(2) Number of Studies. Establish one nested frequency study on each key area; establish more if needed. (See Sections 1 and 5, Technical Reference 4400-1.)

(3) Study Layout. Use the study layout described for the Pace Frequency Method or for the Quadrat Frequency Method. (See Sections 4.44f(3) or 4.45f(4) respectively.)

(4) Reference Post or Point. Permanently mark the location of each study by means of a reference post (steel post) placed about 100 feet from the study location stake or the baseline beginning point stake depending on the study layout. Record the bearing and distance from the post to the study location stake or the baseline beginning point stake. An alternative is to select a reference point, such as a prominent natural or physical feature, and record the bearing and distance from that point to the study location stake or the baseline beginning point stake. If a post is used, it should be tagged to indicate that it marks the location of a monitoring study established by the Bureau of Land Management and that it should not be disturbed.

(5) Study Identification. Number studies for proper identification to ensure that the data collected can be positively associated with specific sites on the ground. (See Illustration 1.)

(6) Study Documentation. Where the study layout for the Pace Frequency Method is selected, document the location, starting point, bearing, distance between transects, sampling interval, and other pertinent information concerning a study on the Study Location and Documentation Data Form. Where the study layout for the Quadrat Frequency Method is selected, document the location of the baseline, bearing, number of transects, transect locations along the baseline, number of plots (quadrats) per transect,

and other pertinent information concerning a study on the Study Location and Documentation Data Form. (See Illustration 3, this Reference, and Section 6, Technical Reference 4400-1.) Plot the precise location of the studies on detailed maps and/or aerial photos.

g. Taking Photographs. The directions for taking close-up and general view photographs are described in Section 3.4.

h. Sampling Process. In addition to collecting the specific studies data, general observations should be made of the study sites. (See Section 3.5.)

(1) Using the Nested Frequency Plot Frame. By using a nested plot frame, data for four different sized plots are collected and evaluated for preferred frequency values. For most plant species, the frequency values must be between 20 and 80 percent in order to detect change when the study is read again. The data will indicate the size plot needed to effectively sample the particular vegetation/species. Data is collected for all sized plots each time the study is read. Data collected with a given size plot can be compared over time only with data collected with the same size plot. (See Illustration 29.)

(2) Running the Transects. Depending on the study layout selected, run the transects as described for the Pace Frequency Method or for the Quadrat Frequency Method. (See Sections 4.44h(2) and 4.45h(2) respectively.)

(3) Collecting Frequency Data. Collect frequency data for all plant species. (See Section 3.1.) For uniformity in recording data, the four nested plots are numbered from "1" through "4," with the largest plot size corresponding with the higher number. (See Illustration 29.) Determine the smallest size plot in which a plant of the species occurs. Record the data by dot count tally, by species, by plot number (size of plot), by transect, on the Trend Study Data - Nested Frequency Method--Four Transects Form or on the Trend Study Data - Nested Frequency Method--Ten Transects Form. (See Illustrations 25 and 27.) Enter the dot count tally in the quadrant on the form representing the smallest size plot in which a plant of the species occurs. (For example, if one plant of a species occurs inside plot "1" and another plant of that species occurs outside plot "1" but within plot "4," record the species occurrence for plot "1" only. Presence of a species in plot "1" automatically connotes presence of the species in all larger plots.) (See Illustration 29.) Only one tally is made regardless of the number of individual plants of a species that occur within a plot.

(a) Herbaceous plants (grasses and forbs) must be rooted in the plot to be counted.

(b) Trees and shrubs (including half shrubs) are counted if rooted in the plot or if the canopy of these plants overhangs the plot. In some cases, it may be preferable to count trees and shrubs only if they are rooted in the plot.

(c) Annual plants are counted whether green or dried.

(d) Specimens of the plants which are unknown should be collected and marked for later identification.

(e) Frequency occurrence of seedlings by plant species may be tallied.

(f) An alternative method for recording frequency data is explained in Illustration 33.

i. Calculations. Make the compilations and calculations and record the results in the appropriate plot size quadrants and columns on the Trend Study Data - Nested Frequency Method--Four Transect Summary Form or on the Trend Study Data - Nested Frequency Method--Ten Transect Summary Form. (See Illustrations 26 and 28.)

(1) Compiling Data. Determine the number of occurrences for each species for each plot size by transect.

(a) Plot "1." Count the number of occurrences of a species in plot "1" and record the value in the plot "1" quadrant on the summary form.

(b) Plot "2." Count the number of occurrences of the same species in plot "2" and add this value to the value recorded for plot "1." Record the sum in the plot "2" quadrant on the summary form.

(c) Plot "3." Count the number of occurrences of the same species in plot "3" and add this value to the value recorded for plot "2." Record the sum in the plot "3" quadrant on the summary form.

(d) Plot "4." Count the number of occurrences of the same species in plot "4" and add this value to the value recorded for plot "3." Record the sum in the plot "4" quadrant on the summary form.

(2) Calculating Frequency. The percent frequency by species can be calculated for each transect and/or for the total of all transects.

(a) Frequency for Each Transect. Calculate the percent frequency of a plant species by plot size on a transect by multiplying the number of occurrences by 10, if there are 10 samples, by 5, if there are 20 samples, or by 2, if there are 50 samples in the transect. Record the percent frequency in the appropriate plot size quadrant by species by transect on the summary form.

(b) Frequency for Total of All Transects. Calculate the percent frequency of a plant species by plot size for the total of all transects by adding the occurrences of a species by plot size on all transects, dividing the total by the total number of plots sampled for the study, and multiplying the value by 100. Record the percent frequency in the appropriate plot size quadrant on the summary form.

RANGELAND MONITORING - TREND STUDIES

4.47 LINE INTERCEPT METHOD.

a. General Description. The Line Intercept Method consists of horizontal, linear measurements of plant intercepts along the course of a line (tape). It is designed for measuring grass or grass-like plants, forbs, shrubs, and trees. Close-up and general view photographs should be used with this method. The following indicators of trend are monitored with this method: (See Section 3.3.)

(1) Foliar and basal cover

(2) Composition (by cover)

b. Areas of Use. This method is ideally suited for semiarid bunchgrass-shrub vegetation types.

c. Advantages and Limitations. The method can be used for sampling vegetation on both large and small rangeland areas as well as on small plots used in detailed and intensive studies. It is best suited where the plant limits are rather easily defined. This method can be adapted to sampling varying densities and types of vegetation. It is not well adapted, however, for single stemmed species, dense grassland situations, litter, or rock less than 1/2 inch in diameter.

d. Equipment.

(1) Study Location and Documentation Data Form (See Illustration 3.)

(2) Trend Study Data - Line Intercept Method Form (See Illustration 30.)

(3) Photo Identification Label (See Illustration 2.)

(4) Frame to delineate the 3- X 3-foot photo plots

(5) Stakes - 3/4- or 1-inch angle iron not less than 16 inches long

(6) Hammer

(7) Permanent yellow or orange spray paint

(8) Camera - 35-mm with a 28-mm wide-angle lens

(9) Exposure meter (if camera is not equipped with one)

(10) Film

(11) Tripod (optional)

(12) Black felt-tip pen

(13) Stakes which are stout enough to have a tape stretched between them

(14) Tape - 50-, 100-, or 200-foot delineated in tenths and hundredths or a metric tape of the desired length

(15) Compass

(16) Steel post

(17) Post driver

e. Training. A minimum of training is needed to make sure the examiners understand how to lay out a transect, make the measurements, and operate the camera equipment. The examiners must be able to identify the plant species. (See Section 3, this Reference, and Section 4, Technical Reference 4400-1.)

f. Establishing Transects. Careful establishment of transects is a critical element in obtaining meaningful data. (See Sections 5.2 through 5.4, Technical Reference 4400-1.)

(1) Site Selection. Stratify the allotment, wildlife habitat area, herd management area, watershed area, or other designated management area; select the key area(s) and key species; and determine the number, length, and location of the transects. (See Section 5.1, Technical Reference 4400-1.)

(2) Number of Transects. Establish one transect on each key area; establish more if needed. (See Sections 1 and 5, Technical Reference 4400-1.)

(3) Length of Transects. The length of the transect is based on the density and homogeneity of the vegetation. If the vegetation is sparse, a longer transect is needed. Transects may be 50 feet, 100 feet, 200 feet or longer. In some cases, it may be advantageous to establish several shorter transects instead of one long transect.

(4) Transect Layout.

(a) Permanently mark the location of the transect by means of transect location and transect bearing stakes. The transect location stake is placed at the beginning of the transect. After determining the bearing of the transect, a stake is placed at the end of the transect. The distance between the stakes is dependent on the length of the transect. The height of the stakes is dependent on the height of the vegetation.

(b) Paint the transect location and transect bearing stakes with bright-colored permanent spray paint (yellow or orange) to aid in relocation. Repaint these stakes when subsequent readings are made.

(c) Stretch the tape between the stakes as close to the ground as possible with the zero point on the tape aligned with the stake which is the beginning point of the transect. Do not allow vegetation to deflect the alignment of the tape.

(5) Reference Post or Point. Permanently mark the location of each transect by means of a reference post (steel post) placed about 100 feet from the transect location stake. Record the bearing and distance from the post to the transect location stake. An alternative is to select a reference point, such as a prominent natural or physical feature, and record the bearing and distance from that point to the transect location stake. If a post is used, it should be tagged to indicate that it marks the location of a monitoring study established by the Bureau of Land Management and that it should not be disturbed.

(6) Transect Identification. Number transects for proper identification to ensure that the data collected can be positively associated with specific sites on the ground. (See Illustration 1.)

(7) Transect Documentation. Document the location, beginning point, bearing, length, and other pertinent information concerning a transect on the Study Location and Documentation Data Form. (See Illustration 3, this Reference, and Section 6, Technical Reference 4400-1.) Plot the precise location of the transects on detailed maps and/or aerial photos.

g. Taking Photographs. The directions for taking close-up and general view photographs are described in Section 3.4.

h. Sampling Process. Proceed down the tape stretched along the transect line and measure the horizontal linear length of the plant intercepts along that line. Measure grasses and grass-like plants, and rosette forming plants at ground level. For forbs, shrubs, and trees, measure the vertical projection of the foliar cover intercepting the tape. If the measurements are made in 10ths and 100ths of feet, the totals are easily converted to percentages. The measurements are recorded by species on the Trend Study Data - Line Intercept Method Form. (See Section 3.1 and Illustration 30.) In addition to collecting the specific studies data, general observations should be made of the study sites. (See Section 3.5.)

i. Calculations. Make the calculations and record the results on the Trend Study Data - Line Intercept Method Form. (See Illustration 30.)

(1) Cover.

(a) Calculate the percent cover of each plant species by totaling the intercept measurements for all individuals of that species along the transect line and converting this total to a percent.

(b) Where the measurements are made in 10ths and 100ths of feet along a 100-foot transect, the totals for each species are the cover percentages. If a 50-foot transect is used, the totals for each species are doubled to calculate the percent cover by species. If a 200-foot transect is used, the totals for each species are divided by two to calculate the percent cover by species.

(c) Calculate the total cover measured on the transect by adding the cover percentages for all the species. This total could exceed 100% if the intercepts of overlapping canopies are recorded.

(2) Composition. Under this method the species composition is based on the percent cover of the various species. Calculate percent composition by dividing the percent cover for each plant species by the total cover for all plant species.

4.48 STEP-POINT TRANSECT METHOD.

a. General Description. The Step-Point Transect Method consists of observing 200 points along a transect at one-pace or other selected intervals. The point is regarded as the smallest possible plot. Close-up and general view photographs should be used with this method. The indicator of trend monitored with this method is cover (foliar and basal cover and general cover categories, including litter). (See Section 3.3.)

b. Areas of Use. This method has wide applicability and is suited for use with grasses, forbs, shrubs, and trees.

c. Advantages and Limitations. This method is relatively simple and easy to use. It is suitable for measuring major characteristics of the ground and vegetation cover of an area. Large areas can easily be sampled, particularly if the cover is reasonably uniform. It is possible to collect a fairly large number of samples within a relatively short time. A limitation of this method is that there can be variation in the data collected among examiners. Another limitation is that a lot of the less predominant plant species are not hit on the transects and therefore do not show up in the study records. This method is a good method to use in combination with another method.

d. Equipment.

(1) Study Location and Documentation Data Form (See Illustration 3.)

(2) Trend Study Data - Step-Point Transect Method Form (See Illustration 31.)

(3) Photo Identification Label (See Illustration 2.)

(4) Frame to delineate the 3- X 3-foot photo plots

(5) Stakes - 3/4- or 1-inch angle iron not less than 16 inches long

(6) Hammer

(7) Permanent yellow or orange spray paint

(8) Camera - 35-mm with a 28-mm wide-angle lens

(9) Exposure meter (if camera is not equipped with one)

(10) Film

(11) Tripod (optional)

(12) Black felt-tip pen

(13) Tally counter (optional)

(14) Compass

(15) Steel post

(16) Post driver

e. Training. A minimum amount of training is needed for this method. Examiners must be able to identify the plant species, must be familiar with the ground-level cover categories, must know how to collect foliar cover data, and must know how to collect cover data using a notch in the boot. They must also be familiar with the operation of the camera equipment. (See Section 3, this Reference, and Section 4, Technical Reference 4400-1.)

f. Establishing Transects. Careful establishment of transects is a critical element in obtaining meaningful data. (See Sections 5.2 through 5.4, Technical Reference 4400-1.)

(1) Site Selection. Stratify the allotment, wildlife habitat area, herd management area, watershed area, or other designated management area; select the key area(s) and key species; and determine the number, length, and location of the transects. (See Section 5.1, Technical Reference 4400-1.)

(2) Number of Transects. Establish one transect on each key area; establish more if needed. (See Sections 1 and 5, Technical Reference 4400-1.)

(3) Transect Layout.

(a) Drive an angle iron location stake into the ground to permanently mark the location of each transect.

(b) Paint the transect location stake with bright-colored permanent spray paint (yellow or orange) to aid in relocation. Repaint this stake when subsequent readings are made.

(c) Determine the transect bearing and select a prominent distant landmark such as a peak, rocky point, etc., that can be used as the transesct bearing point.

(4) Reference Post or Point. Permanently mark the location of each transect by means of a reference post (steel post) placed about 100 feet from the transect location stake. Record the bearing and distance

from the post to the transect location stake. An alternative is to select a reference point, such as a prominent natural or physical feature, and record the bearing and distance from that point to the transect location stake. If a post is used, it should be tagged to indicate that it marks the location of a monitoring study established by the Bureau of Land Management and that it should not be disturbed.

(5) Transect Identification. Number transects for proper identification to ensure that the data collected can be positively associated with specific sites on the ground. (See Illustration 1.)

(6) Transect Documentation. Document the location, starting point, bearing, sampling interval, length, and other pertinent information concerning a transect on the Study Location and Documentation Data Form. (See Illustration 3, this Reference, and Section 6, Technical Reference 4400-1.) Plot the precise location of the transects on detailed maps and/or aerial photos.

g. Taking Photographs. The directions for taking close-up and general view photographs are described in Section 3.4.

h. Sampling Process. In addition to collecting the specific studies data, general observations should be made of the study sites. (See Section 3.5.)

(1) Running the Transects.

(a) Start a transect by taking five paces from the transect location stake along the transect bearing before reading the first hit (observation point).

(b) Read hits at one-pace intervals for a total of 200 hits. To lengthen the transects, pace off some desired distance (5 paces, 20 paces, etc.) between hits.

(c) When obstructions such as juniper trees, cholla cactus, or ledge rock, etc., are encountered, sidestep at 90° from the transect line and continue pacing parallel to the transect to avoid the obstructions. Project an estimate of actual hits along the original transect line. Return to the original transect line as soon as possible by sidestepping at 90° in the opposite direction. Continue pacing along the transect bearing.

(d) In some cases it may be preferable not to count hits along that portion of a transect which intersects unnaturally disturbed areas, such as roads or trails. When such areas are encountered, proceed three paces past the disturbance before resuming the reading of hits along the transect line.

(2) Collecting Cover Data. At each observation point, identify the hit with a 1/8-inch mark, preferably a notch 1/8-inch wide and 1/16-inch deep, on the toe of the sole of the boot. Wider or deeper notches affect the decision as to what to record. Read the hit and record the data by dot count tally, by cover category and/or plant species code (symbol), on the Trend Study Data - Step-Point Transect Method Form. (See Illustrations 31 and 32.)

(a) Ground-Level Hits.

i. Ground-level hits will fall into one of seven cover categories:

B - Bare ground

P - Persistent litter (large mammal droppings and woody material)

N - Non-persistent litter (lasts less than 2 years; herbaceous)

G - Gravel (2 mm [approximately 1/12 inch] to 3 inches)

C - Cobble (>3 inches to 10 inches)

S - Stone (>10 inches)

R - Bedrock

ii. Identify the cover category or hit directly beneath the notch.

iii. If two or more items such as bare ground and litter appear in the notch, record the item which occupies the majority of the notch.

iv. Identity of the cover must be expressed as a single category. Therefore, where two or more apparently equal categories are identified, the preferred identity is: first, live vegetation; second, litter; third, gravel; fourth, cobble; fifth, stone; and sixth, bare ground.

v. Record the ground-level hits by dot count tally by ground-level cover category in the Ground-Level Cover Section of the form except where there are ground-level and foliar cover hit combinations.

(b) Basal Hits.

i. Identify the basal hits on live vegetation by species (includes mosses and lichens more than 1/16 inch thick). To count as a basal hit on live vegetation, the plant crown at a 1-inch height above the ground must occupy the notch.

ii. Enter the appropriate plant species code (symbol) in the Basal or Ground-Level Column in the Basal and Foliar Cover Section of the form.

iii. Enter a dot count tally for each basal hit on a species in the Dot Count Column in the Basal and Foliar Cover Section of the form when the plant species code (symbol) is first entered on the form. Enter an additional dot count tally each time there is a basal hit on that species on the transect, except where there are basal and foliar cover hit combinations.

(c) Ground-Level or Basal and Foliar Cover Hit Combinations.

i. Identify the ground-level or basal hit and the foliar cover hit(s) in the line of sight of the notch.

ii. Dead vegetation in the canopy is counted as litter. (Use "P"-persistent litter and "N"-non-persistent litter.)

iii. If vegetation and/or litter is pushed out of its natural canopy, visually reconstruct the natural canopy to determine foliar cover hit(s).

iv. Enter the appropriate ground-level cover category code (see Section 4.48h(2)(a)i) and/or plant species code (symbol) for each level of hit (up to four levels) in the appropriate columns in the Basal and Foliar Cover Section of the form.

v. Plant codes for vegetation foliar cover hits more than 20 feet above the ground level should be enclosed in brackets [ ].

vi. Enter a dot count tally for each ground-level or basal and foliar cover hit combination when it is first entered on the form and each time this same combination is hit on the transect.

i. Calculations. Determine the total hits for the ground-level cover categories, the basal cover only entries, and the ground-level or basal and foliar cover combinations from the dot count tallies and record in the appropriate blocks and column on the Trend Study Data - Step-Point Transect Method Form. (See Illustration 31.)

RANGELAND MONITORING - TREND STUDIES

GLOSSARY OF TERMS

-A-

actual use: a report of the actual livestock grazing use certified to be accurate by the permittee or lessee. Actual use may be expressed in terms of animal unit months or animal months. (See 43 CFR 4100.0-5.)

allotment: an area of land designated and managed for grazing of livestock. Such an area may include intermingled private, State, or Federal lands used for grazing in conjunction with the public lands. (See 43 CFR 4100.0-5.)

allotment management plan (AMP): a documented program which applies to livestock grazing on the public lands, prepared in consultation, cooperation, and coordination with the permittee(s), lessee(s), or other involved affected interests. (See 43 CFR 4100.0-5.)

analysis: (1) a detailed examination of anything complex in order to understand its nature or determine its essential features; or (2) a separating or breaking up of any whole into its component parts for the purpose of examining their nature, function, relationship, etc. (A rangeland analysis includes an examination of both biotic (plants, animals, etc.) and abiotic (soils, topography, etc.) attributes of the rangeland.)

animal month: a month's tenure upon the rangeland by one animal. Animal month is not synonymous with animal unit month.

animal unit month (AUM): the amount of forage necessary for the sustenance of one cow or its equivalent for a period of one month. (See 43 CFR 4100.0-5.)

available forage: that portion of the forage production that is accessible for use by a specified kind or class of grazing animal.

-B-

bare ground: all land surface not covered by vegetation, rock fragment, bedrock, or litter.

basal area: the cross sectional area of the stem or stems of a plant or of all plants in a stand. Herbaceous and small woody plants are measured at or near the ground level; large woody plants are measured at breast or other designated height. Basal area is synonymous with basal cover.

basal cover: (See basal area.)

bedrock: in-place, solid rock exposed at the surface of the earth or overlain by unconsolidated material.

boulder: descriptive term applied to rock fragment ground cover where the longest dimension measures over 24 inches.

browse: (1) the part of shurubs, half shrubs, woody vines, and trees available for animal consumption; or (2) to search for or consume browse.

browse plant or browse species: a shrub, half shrub, woody vine, or tree capable of producing shoot, twig, and leaf growth suitable for animal consumption.

-C-

canopy cover: the percentage of ground covered by a vertical projection downward of the outermost perimeter of the natural spread of foliage of plants. Small openings within the canopy are included. It may exceed 100 percent. Canopy cover is synonymous with crown cover.

class of livestock: the age and/or sex groups of a kind of livestock.

climate: the average weather conditions of a place over a period of years.

cobble: descriptive term applied to rock fragment ground cover where the longest dimension measures 3 to 10 inches.

community: an assemblage of populations of plants and/or animals in a common spatial arrangement.

composition: the proportions (percentages) of various plant species in relation to the total on a given area. It may be expressed in terms of cover, density, weight, etc.

cover: (See canopy cover, foliar cover, and ground cover.)

crown cover: (See canopy cover.)

cryptogam: a plant in any of the groups Thallophytes, Bryophytes, and Pteridophytes--mosses, lichens, and ferns.

-D-

density: numbers of individuals or stems per unit area. (Density does not equate to any kind of cover measurement.)

-E-

ecological site: (See range site.)

ecological status: the present state of vegetation of a range site in relation to the potential natural community for the site. Ecological status is use independent. It is an expression of the relative degree to which the kinds, proportions, and amounts of plants in a community resemble that of the potential natural community. The four ecological status classes correspond to 0-25, 26-50, 51-75, or 76-100 percent similarity to the potential natural community and are called early seral, mid seral, late seral, and potential natural community, respectively.

erosion: the detachment and movement of soil particles or rock fragments by the action of water, wind, ice, or gravity.

estimated use: the use made of forage on an area by wildlife, wild horses, wild burros, and/or livestock where actual use data are not available. Estimated use may be expressed in terms of animal unit months or animal months.

evaluation: (1) an examination and judgment concerning the worth, quality, significance, amount, degree, or condition of something; or (2) the systematic process for determining the effectiveness of on-the-ground management actions and assessing progress toward meeting management objectives.

-F-

foliar cover: the percentage of ground covered by a vertical projection downward of the aerial portion of plants. Small openings in the canopy and intraspecific overlap are excluded. Foliar cover is always less than canopy cover. It may exceed 100 percent.

forage: (1) browse and herbage which is available and may provide food for animals or be harvested for feeding; or (2) to search for or consume forage.

forage production: the weight of forage that is produced within a designated period of time or a given area. Production may be expressed as green, air dry, or oven dry weight. The term may also be modified as to time of production such as annual, current year, or seasonal forage production.

forb: (1) any herbaceous plant other than those in the Gramineae (true grasses), Cyperaceae (sedges), and Juncaceae (rushes) families--i.e., any nongrass-like plant having little or no woody material on it; or (2) a broadleaved flowering plant whose stem, above ground, does not become woody and persistent.

forestland: land on which the vegetation is dominated by trees. Lands are classified forestland if the trees now present will provide 25 percent or greater canopy cover at maturity. Lands not presently forestland that were originally or could become forested through natural succession may be classified as potential natural forestland.

frequency: a quantitative expression of the presence or absence of individuals of a species in a population. It is defined as the percentage of occurrrence of a species in a series of samples of uniform size.

-G-

goal: the desired state or condition that a resource management policy or program is designed to achieve. A goal is usually not quantifiable and may not have a specific date by which it is to be completed. Goals are the base from which objectives are developed. (See objective.)

grass: any plant of the family Gramineae.

grassland: land on which the vegetation is dominated by grasses, grasslike plants, and/or forbs. Non-forested lands are classified as grassland if herbaceous vegetation provides at least 80 percent of the canopy cover excluding trees. Lands not presently grassland that were originally or could become grassland through natural succession may be classified as potential natural grassland.

grasslike plant: a plant of the Cyperaceae or Juncaceae families which vegetatively resembles a true grass of the Gramineae family.

gravel: descriptive term applied to rock fragment ground cover where the longest dimension measures 2 millimeters (approximately 1/12-inch) to 3 inches.

ground cover: the percentage of material, other than bare ground, covering the land surface. It may include live and standing dead vegetation, litter, gravel, cobble, stones, boulders, and bedrock. Ground cover plus bare ground would total 100 percent.

grazing management: the manipulation of grazing and browsing animals to accomplish a desired result.

-H-

half shrub: a plant with a woody base whose annually produced stems die each year.

hedging: (1) the appearance of browse plants that have been browsed so as to appear artificially clipped; or (2) consistent browsing of terminal buds of browse species causing excessive lateral branching and a reduction in upward and outward growth.

herbage: the above-ground material of any herbaceous plant (grasses and forbs).

-I-

interpretation: explaining or telling the meaning of something and presenting it in understandable terms.

inventory: the systematic acquisition and analysis of information needed to describe, characterize, or quantify resources for land-use planning and management of the public lands.

-K-

key area: a relatively small portion of a rangeland selected because of its location, use, or grazing value as an area on which to monitor the effects of grazing use. It is assumed that key areas, if properly selected, will reflect the effects of current grazing management over all or a part of a pasture, allotment, or other grazing unit.

key species: (1) those species which must, because of their importance, be considered in a management program; or (2) forage species whose use serves as an indicator to the degree of use of associated species.

kind of livestock: species of domestic livestock--cattle, sheep, horses, burros, and goats.

-L-

litter: the uppermost layer of organic debris on the soil surface; essentially the freshly fallen or slightly decomposed vegetal material.

-M-

monitoring: the orderly collection, analysis, and interpretation of resource data to evaluate progress toward meeting management objectives.

moss and lichen: small, low growing plants usually found in patches on litter, rock fragments, soil, etc.

-N-

non-persistent litter: undecomposed organic debris on or near the soil surface with expected decomposition rate of two years or less. Composed primarily of herbaceous material.

-O-

objective: planned results to be achieved within a stated time period. Objectives are subordinate to goals, are narrower and shorter in range, and have increased possibility of attainment. Time periods for completion and outputs or achievements that are measurable and quantifiable are specified. (See goal.)

-P-

pasture: grazing area enclosed and separated from other areas by fence or natural barrier.

persistent litter: undecomposed organic debris on or near the soil surface with expected decomposition rate exceeding two years. Composed of woody material and large mammal droppings.

phenology: the relationship between climate and plant growth stages such as begin growth, peak flowering, seed ripe, dormant, etc.

physiognomy: external aspect; characteristic or peculiar contour.

plant association: a kind of potential natural community consisting of stands with essentially the same dominant species in corresponding layers.

plant community: (See community.)

potential natural community (PNC): the biotic community that would become established if all successional sequences were completed without interferences by man under the present environmental conditions. Natural disturbances are inherent in development. Includes naturalized non-native species.

production: (See forage production.)

proper use: (1) a degree of utilization of current year's growth which, if continued, will achieve management objectives and maintain or improve the long-term productivity of the site; or (2) the percentage a plant is utilized when the rangeland as a whole is properly utilized. Proper use varies with time and systems of grazing. Proper use is synonymous with proper utilization.

proper utilization: (See proper use.)

public lands: any land and interest in land outside of Alaska owned by the United States and administered by the Secretary of the Interior through the Bureau of Land Management. (See 43 CFR 4100.0-5.)

-R-

rangeland: a kind of land which supports vegetation useful for grazing on which routine management of that vegetation is through manipulation of grazing rather than cultural practices. (Rangelands include natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, riparian zones, and wet meadows. Rangeland includes lands revegetated naturally or artificially to provide a plant cover which is managed like native vegetation.)

range site: a kind of rangeland with a specific potential natural community and specific physical site characteristics, differing from other kinds of rangeland in its ability to produce vegetation and to respond to management. Range sites are defined and described with soil, species composition, and production emphasis. Range site is synonymous with ecological site.

resource value rating (RVR): the value of vegetation present on a range site for a particular use or benefit. Resource value ratings may be established for each plant community capable of being produced on a range site, including exotic or cultivated species. On a given range site, each use (or potential use) has a separate resource value rating because that rating is based on classification of plants according to their value for a specific use. Some examples: A resource value rating for forage useful for cows and calves during the spring grazing season could be based on proper use factors (PUF's) or a more general assigning of plant species to good, moderate, or poor categories of forage value. Resource value ratings could then be based on production, cover, density, or frequency of plants in the different categories. A resource value rating for cover useful for a pronghorn fawning area might be based on density or cover of plants of a certain height or size class, without regard to plant species. A resource value rating related to scenic beauty might be based on abundance of flowering species, species with fall color, evergreens, diversity of growth forms, etc.

riparian zone: the banks and adjacent areas of water bodies, water courses, seeps, and springs whose waters provide soil moisture sufficiently in excess of that otherwise available locally so as to provide a more moist habitat than that of contiguous flood plains and uplands.

rock fragment: an individual fragment of solid mineral material which occurs naturally on the earth's crust and ranges in size from gravel to boulder.

-S-

savanna: a grassland with scattered trees, whether as individuals or clumps; often a transitional type between true grassland and forest.

seral community: one of a series of biotic communities that follow one another in time on any given area. Seral community is synonymous with seral stage, successional community, and successional stage.

seral stage: (See seral community.)

shrub: a plant that has persistent, woody stems and a relatively low growth habit, and that generally produces several basal shoots instead of a single bole. It differs from a tree by its low stature--less than 5 meters (16 feet)--and nonarborescent form.

shrubland: land on which the vegetation is dominated by shrubs. Non-forested lands are classified as shrubland if shrubs provide more than 20 percent of the canopy cover excluding trees. Lands not presently shrubland that were originally or could become shrubland through natural succession may be classified as potential natural shrubland.

stone: descriptive term applied to rock fragment ground cover where the longest dimension measures 10 to 24 inches.

stratification: subdividing an area into units which are, more or less, internally homogeneous with respect to the (those) characteristic(s) of interest.

succession: the orderly process of community change; it is the sequence of communities which replace one another in a given area.

successional community: (See seral community.)

successional stage: (See seral community.)

-T-

tree: a woody perennial, usually single-stemmed plant that has a definite crown shape and characteristically reaches a mature height of at least 5 meters (16 feet). Some plants, such as oaks (Quercus spp.), may grow as either trees or shrubs.

trend: the direction of change in ecological status or in resource value ratings observed over time. Trend in ecological status is described as "toward" or "away from" the potential natural community or as "not apparent." Appropriate terms are used to describe trend in resource value ratings. Trend in resource value ratings for several uses on the same site at a given time may be in different directions and there is no necessary correlation between trends in resource value ratings and trend in ecological status.

-U-

use: (See utilization.)

useable forage: that portion of the forage that can be grazed without damage to the basic resources; may vary with season of use, species, and associated species.

utilization: the proportion or degree of current year's forage production that is consumed or destroyed by animals (including insects). May refer either to a single plant species, a group of species, or to the vegetation as a whole. Utilization is synonymous with use.

-V-

vegetation: plants in general, or the sum total of the plant life above and below ground in an area.

vegetation hit: a point on a plant either basal or canopy. (Lichens and mosses must exceed 1/16 inch in thickness to qualify as a vegetation hit. Lichens and mosses less than 1/16 inch in thickness growing on rock are considered as rock; if they are growing on bare ground, they are considered as persistent litter.)

vegetation type: a kind of existing plant community with distinguishable characteristics described in terms of the present vegetation that dominates the aspect or physiognomy of the area.

vigor: relates to the relative robustness of a plant in comparison to other individuals of the same species. It is reflected primarily by the size of a plant and its parts in relation to its age and the environment in which it is growing.

-W-

weather: the state of the atmosphere at a definite time and place with respect to air temperature, humidity, wind, precipitation, cloudiness, etc.

wet meadow: a meadow where the surface remains wet or moist throughout the summer, usually characterized by sedges and rushes.

RANGELAND MONITORING - TREND STUDIES

STUDY AND PHOTOGRAPH IDENTIFICATION

A. NUMBERING STUDIES. Studies should be numbered to assure positive identification. These numbers can also be used to identify photographs. Following are three alternative schemes for numbering studies:

1. Numbering Scheme 1. Consecutive numbers may be assigned to studies within an allotment. For example: Mooncreek #1 and Mooncreek #2 would be studies Number 1 and 2 within the Mooncreek Allotment. A disadvantage to using the names of allotments in a numbering scheme is that these names can, and often do, change.

2. Numbering Scheme 2. Studies may be numbered based on their location within a township, range, and section. A 10-character number can be assigned in the following manner:

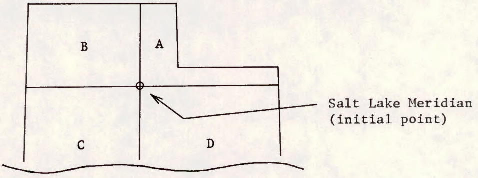
a. The first three characters are the township (03S), the second three are the range (27W), the next two are the section (08), and the last two are simply a series number (01) assigned to a study based on the number of studies located within a section.

b. The numbers for studies located in Section 8 would be 03S-27W-08-01, 03S-27W-08-02, and so forth.

c. Depending on the local situation, this scheme can be modified by adding characters to the code where there are fractional townships or ranges, where there are more than 99 sections/tracts within a township, and/or where there is more than one public land survey principal meridian and baseline within the area of jurisdiction.

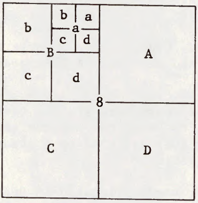
3. Numbering Scheme 3. Studies may be numbered based on their location relative to the initial point of survey (principal meridian and baseline governing public land survey).

a. Under this scheme, the first character is a letter assigned to a principal meridian and baseline quadrant. Using the initial point of the survey as the center point, the northeast quadrant (townships located to the north and east of the initial point) is coded "A". The northwest, southwest, and southeast quadrants are coded "B", "C", and "D" respectively. For example:



b. The next characters are the township number (3, 16, etc.) followed by the range number (7, 32, etc.) and the section number (8, 21, etc.).

c. The next three characters are used to identify the subdivisions within a section (down to 10 acres) in which a study is located. These subdivisions have letter designations as follows:



d. The last character(s) is (are) simply a series number (1, 2, 3, . . . 10, 11, etc.) assigned to a study based on the number of studies located within the smallest subdivision.

e. For example, Studies 1 and 2 located in the SE1/4NE1/4NW1/4 of Section 8, T3S, R21E would be numbered (D-3-21)8Bad-1 and (D-3-21)8Bad-2.

f. Depending on the local situation, this scheme can be modified by adding characters to the code where there are fractional townships or ranges, where there are more than 99 sections/tracts within a township, and/or where there is more than one public land survey principal meridian and baseline within the area of jurisdiction.

B. IDENTIFYING PHOTOGRAPHS. In most cases, the number that has been assigned to a study is the number used to identify the photographs associated with that study. Following is a description of three labels that can be used to include the study number in the photographs:

1. Label 1. The Photo Identification Label included as Illustration 2 can be copied and used to identify photographs. This label provides space for documenting the date, number, and location (Resource Area, allotment, and pasture) of a study. A large black felt-tip marking pen should be used to print the information on the label.

2. Label 2. A slotted sign board with a black felt background and movable white plastic letters can be used as a photo identification label. Room permitting, the user may include any information desired on such a label. A 9- x 12-inch board with slots running lengthwise at a spacing of 1/4 inch and 1 1/2-inch white letters makes a highly visible label for most photographs.

3. Label 3. A placard on which identifying characteristics can be entered can be developed to meet local field needs. The placard can be constructed of heavy white cardboard on which such things as Date, "T" (township), "R" (range), Section Number, etc., are preprinted. A heavy mylar film can be placed over the preprinted placard. The specific identifying information can be hand printed on the mylar with a heavy grease pencil or other readily removable, highly visible, marking material. After taking the desired photographs, the mylar can be wiped clean and the placard reused for other photographs. A more permanent placard can be constructed of plywood and painted enamel white. The grease pencil markings can be wiped from the enameled surface and the placard reused for other photographs. Caution must be exercised in the placement of the placard to prevent glare from the mylar or enameled surface.

NOTE - Labels can be placed flat on the ground immediately adjacent to photo plots for close-up photographs. (See Illustration 4.)

- Labels can be placed in an upright position in the foreground of general view photographs.

Illustration 2
Page 1

DATE ______________________

NO. ______________________

R.A. ______________________

ALLOT. ______________________

PAST. ______________________

PHOTO IDENTIFICATION LABEL

DATE 7/24/84

NO. 03S-27W-08-03

R.A. LOST MOUNTAIN

ALLOT. QUAKING ASPEN

PAST. SHEEP CREEK

PHOTO IDENTIFICATION LABEL

Illustration 3
Page 1

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

STUDY LOCATION & DOCUMENTATION DATA

STUDY METHOD
STUDY NUMBER

ALLOTMENT NAME & NUMBER
PASTURE

DISTRICT
RESOURCE AREA
PLANNING UNIT

RANGE SITE
PLANT COMMUNITY

DATE ESTABLISHED
ESTABLISHED BY (NAME)
MAP REFERENCE

ELEVATION
SLOPE
EXPOSURE
AERIAL PHOTO REFERENCE

	TOWNSHIP	RANGE	SECTION	1/4	1/4	1/4
LOCATION						

SCALE:____INCHES
EQUALS ONE MILE

KEY SPECIES
1 2 3

DISTANCE & BEARING BETWEEN REFERENCE POST OR REFERENCE POINT AND THE TRANSECT LOCATION STAKE, BEGINNING OF TRANSECT, OR PLOT

DISTANCE & BEARING BETWEEN LOCATION STAKE & BEARING STAKE

TRANSECT BEARING
VERTICAL DISTANCE BETWEEN GROUND & ALIGNED TAPE

LENGTH OF TRANSECT
PLOT/FRAME SIZE

SAMPLING INTERVAL
TOTAL NUMBER OF SAMPLES

NOTES (DESCRIPTION OF STUDY LOCATION, DIAGRAM OF TRANSECT/PLOT LAYOUT, DESCRIPTION OF PHOTO POINTS, ETC. IF MORE SPACE IS NEEDED, USE REVERSE SIDE OR ANOTHER PAGE.)

Illustration 3
Page 2

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

STUDY LOCATION & DOCUMENTATION DATA

STUDY METHOD: DAUBENMIRE TREND
STUDY NUMBER: 03S-27W-08-03

ALLOTMENT NAME & NUMBER: QUAKING ASPEN - 1037
PASTURE: SHEEP CREEK

DISTRICT: HOWE
RESOURCE AREA: LOST MOUNTAIN
PLANNING UNIT: DEEP CANYON

RANGE SITE: CLAYEY-15-19" NORTHERN PLAINS
PLANT COMMUNITY: ARTR2-AGSP-PONE3

DATE ESTABLISHED: 7/24/84
ESTABLISHED BY (NAME): CHARLIE WAGON
MAP REFERENCE: GRAYSTONE 7½ MIN. TOPO.

ELEVATION: 4300
SLOPE: FLAT
EXPOSURE: EAST
AERIAL PHOTO REFERENCE: BLM-24CN-A277A-4/22/78

	TOWNSHIP	RANGE	SECTION	1/4	1/4	1/4
LOCATION	3S	27W	8	NW	SE	NW

SCALE: 2 INCHES EQUALS ONE MILE

KEY SPECIES
1 AGSP 2 PONE3 3

	X		

DISTANCE & BEARING BETWEEN REFERENCE POST OR REFERENCE POINT AND THE TRANSECT LOCATION STAKE, BEGINNING OF TRANSECT, OR PLOT
The transect location stake is 100 feet south (180°) of the reference post. Reference post is 3 miles west of Redtop Reservoir.

DISTANCE & BEARING BETWEEN LOCATION STAKE & BEARING STAKE
102 feet at 135°

TRANSECT BEARING

VERTICAL DISTANCE BETWEEN GROUND & ALIGNED TAPE
3 inches

LENGTH OF TRANSECT
100 FEET

PLOT/FRAME SIZE
20 x 50 cm - 6 cover classes

SAMPLING INTERVAL Every 2 feet beginning at the 1-foot mark on the tape. Place the rear left corner of the frame at every 2nd foot mark along the right side of the tape.

TOTAL NUMBER OF SAMPLES
50

NOTES (DESCRIPTION OF STUDY LOCATION, DIAGRAM OF TRANSECT/PLOT LAYOUT, DESCRIPTION OF PHOTO POINTS, ETC. IF MORE SPACE IS NEEDED, USE REVERSE SIDE OR ANOTHER PAGE.)

The two photo plots are located at 37 and 53 feet along the tape.
Close-up photos are taken from the northeast side of the photo plots.

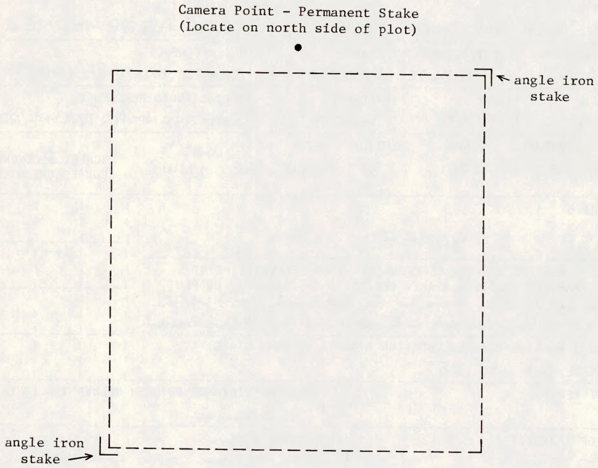
Note: Depending on the study method, fill in the blocks that apply when a study is established. This documentation enables the examiners to conduct follow-up studies in a consistent manner to provide comparable data for analysis, interpretation, and evaluation.

Illustration 4

RANGELAND MONITORING - TREND STUDIES

PERMANENT PHOTO PLOT LOCATION

(3- X 3-Foot or 5- X 5-Foot Plot Outline)


Camera Point - Permanent Stake
(Locate on north side of plot)
angle iron stake
angle iron stake

Paint the stakes with bright-colored permanent spray paint (yellow or orange) to aid in relocation. Repaint these stakes when subsequent photographs are taken.

TREND STUDY METHOD MATRIX

Trend Study Method	Indicators of Trend							
	Cover	Density	Frequency	Litter	Age and Form Class	Reproduction	Vigor	Composition
Photo Plot	foliar and basal	X		X		X		by cover
Community Structure Analysis	foliar	X	X	X				by cover and density
Daubenmire	canopy		X					by cover
Pace Frequency	basal (not by species) and general cover categories		X	X				
Quadrat Frequency	basal (not by species) and general cover categories		X	X		X		
Nested Frequency			X					
Line Intercept	foliar and basal							by cover
Step-Point Transect	foliar and basal and general cover categories			X				
Twig Length Measurement							growth index	
Cole Browse					X		growth index	by age and form class for browse only
Extensive Browse					X			by age and form class and by species for browse only

Illustration 6
Page 1

UNITED STATES
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TREND STUDY DATA
PHOTO PLOT METHOD

STUDY NUMBER

DATE

EXAMINER

ALLOTMENT NAME & NUMBER

PASTURE

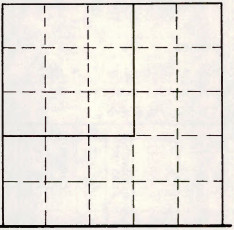
PART I - PLOT DATA BY SQUARE FOOT SECTION

SPECIES																						
GRASS	FORB	SHRUB	MATURE PLANTS	SEEDLINGS	1/16 UNITS	TOTAL SQ. INCHES	MATURE PLANTS	SEEDLINGS	1/16 UNITS	TOTAL SQ. INCHES	MATURE PLANTS	SEEDLINGS	1/16 UNITS	TOTAL SQ. INCHES	MATURE PLANTS	SEEDLINGS	1/16 UNITS	TOTAL SQ. INCHES	MATURE PLANTS	SEEDLINGS	1/16 UNITS	TOTAL SQ. INCHES
	(a)		(b)	(c)	(d)	(e)	(b)	(c)	(d)	(e)	(b)	(c)	(d)	(e)	(b)	(c)	(d)	(e)	(b)	(c)	(d)	(e)
	LITTER		▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨
	LITTER		▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨
	LITTER		▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨
	LITTER		▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨
	LITTER		▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨

PART II – SUMMARY OF PLOT DATA

LIST BY SPECIES	NUMBER		1/16 SQ. FT. UNITS *(estimate)*	TOTAL SQ. IN. *(measurement)*	PERCENT	
	MATURE PLANTS	SEEDLINGS			COVER	COMPOSITION
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Grasses (Basal Cover)						
GRASS TOTALS						
Forbs (Foliar Cover)						
FORB TOTALS						
Shrubs (Foliar Cover)						
SHRUB TOTALS						
VEGET. TOTALS	▨	▨	▨			
Litter	▨	▨		▨		▨

PART III – PLOT DIAGRAM



PART IV – TREND INDEX SUMMARY

Composition, Key Species *(percent)*	
Cover, Live Vegetation *(percent)*	
Seedlings, Key Species *(number)*	
Litter, Plot Total *(percent)*	
TOTAL	

SPECIFIC INSTRUCTIONS

(Items not listed are self-explanatory)

PART I – PLOT DATA BY SQUARE FOOT SECTION

Record data for each 1' × 1' section of the plot

Column (a) – Use the standard plant code (scientific symbol). Indicate which species are the key species.
Columns (b) & (c) – Enter number
Column (d) – *Estimate* – 1/16 sq. feet units covered by species.
Column (e) – *Measure* – Total sq. inches covered by species.
Note: Use *either* estimate *or* measurement for *each* species. Do *not* use both.
Total – Total data for *each* species and enter in Part II.

PART II – SUMMARY OF PLOT DATA

Column (f) – To convert measurement data to percent cover – $\frac{\text{Measured sq. inches } (\textit{Column (e)})}{1296\ (3' \times 3' \text{ plot}) \text{ or } 3600\ (5' \times 5' \text{ plot})} \times 100$ = percent cover

– To convert estimate data to percent cover – Multiply Column (d) by 0.7 (3' × 3' plot) or 0.25 (5' × 5' plot) = percent cover

Column (g) – To calculate composition – $\frac{\%\text{ Cover } (\textit{Column (f)}) \text{ of each species}}{\text{Total } \%\text{ vegetation cover } (\textit{of plot in Column (f)})} \times 100$ = percent composition

UNITED STATES
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TREND STUDY DATA
PHOTO PLOT METHOD

STUDY NUMBER: 34S-02W-17-02
DATE: 6/19/84
EXAMINER: AL ZISK

ALLOTMENT NAME & NUMBER: BLACK BUTTE - 1234
PASTURE: BUTTE

PART I – PLOT DATA BY SQUARE FOOT SECTION

SPECIES																						
GRASS	FORB	SHRUB	MATURE PLANTS	SEEDLINGS	1/16 UNITS	TOTAL SQ. INCHES	MATURE PLANTS	SEEDLINGS	1/16 UNITS	TOTAL SQ. INCHES	MATURE PLANTS	SEEDLINGS	1/16 UNITS	TOTAL SQ. INCHES	MATURE PLANTS	SEEDLINGS	1/16 UNITS	TOTAL SQ. INCHES	MATURE PLANTS	SEEDLINGS	1/16 UNITS	TOTAL SQ. INCHES
	(a)		(b)	(c)	(d)	(e)	(b)	(c)	(d)	(e)	(b)	(c)	(d)	(e)	(b)	(c)	(d)	(e)	(b)	(c)	(d)	(e)
AGSP	-key species		2		.4		1		.4													
POSE			2		.2		3		.5													
	PHHO		1		.1		–		.1													
	LITTER				4.3				.8				.1									
POSE			7		.6		4		.5		2		.3									
SIHY											2		.5									
FEIO	-key species		–		.2																	
	PHHO		1		.2						2		.4									
AGSP							1		.1													
	LITTER				.7				.1				.8									
POSE			2		.2		–		T		8		.8									
FEIO			3		4.1		–	1	.4													
	PHHO										2		.6									
		ARAR8									1		.1									
AGSP							–		T													
	LITTER				4.9				.3				.6									
	LITTER																					
	LITTER																					

← ANGLE IRON STAKE

N

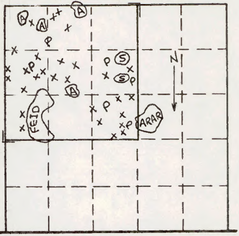
ANGLE IRON STAKE

CAMERA POINT

PART II – SUMMARY OF PLOT DATA

LIST BY SPECIES	NUMBER		1/16 SQ. FT. UNITS *(estimate)*	TOTAL SQ. IN. *(measurement)*	PERCENT	
	MATURE PLANTS	SEEDLINGS			COVER	COMPOSITION
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Grasses (Basal Cover)						
AGSP (Key Sp.)	4		0.9		.63	8.4
POSE	28		3.1		2.17	29.0
SIHY	2		0.5		.35	4.7
FEIO (Key Sp.)	3	1	4.7		3.29	43.9
GRASS TOTALS	37	1	9.2		6.44	86.0
Forbs (Foliar Cover)						
PHHO	6		1.4		.98	13.1
FORB TOTALS	6		1.4		.98	13.1
Shrubs (Foliar Cover)						
ARAR8	1		0.1		.07	.9
SHRUB TOTALS	1		0.1		.07	.9
VEGET. TOTALS					7.49	100.0
Litter			12.6		8.82	

PART III – PLOT DIAGRAM



P - PHHO
x - POSE
Ⓢ-SIHY
Ⓐ-AGSP
L - ANGLE IRON STAKES

PART IV – TREND INDEX SUMMARY

Composition, Key Species *(percent)*	52.3
Cover, Live Vegetation *(percent)*	7.49
Seedlings, Key Species *(number)*	1
Litter, Plot Total *(percent)*	8.82
TOTAL	69.61

SPECIFIC INSTRUCTIONS

(Items not listed are self-explanatory)

PART I – PLOT DATA BY SQUARE FOOT SECTION

Record data for each 1' × 1' section of the plot

Column (a) – Use the standard plant code (scientific symbol). Indicate which species are the key species.
Columns (b) & (c) – Enter number
Column (d) – *Estimate* – 1/16 sq. feet units covered by species.
Column (e) – *Measure* – Total sq. inches covered by species.
Note: Use *either* estimate *or* measurement for *each* species. Do *not* use both.
Total – Total data for *each* species and enter in Part II.

PART II – SUMMARY OF PLOT DATA

Column (f) – To convert measurement data to percent cover –

$$\frac{\text{Measured sq. inches } \textit{(Column (e))}}{1296\ (3' \times 3' \text{ plot) or } 3600\ (5' \times 5' \text{ plot)}} \times 100 = \text{percent cover}$$

– To convert estimate data to percent cover – Multiply Column (d) by 0.7 (3' × 3' plot) or 0.25 (5' × 5' plot) = percent cover

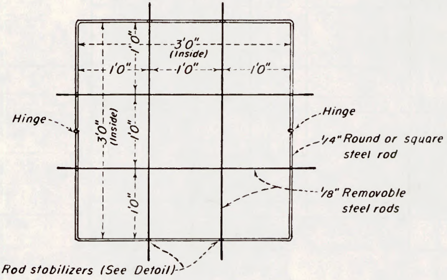
Column (g) – To calculate composition –

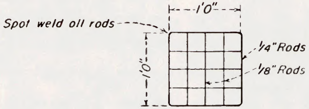
$$\frac{\%\text{ Cover } \textit{(Column (f))} \text{ of each species}}{\text{Total }\%\text{ vegetation cover } \textit{(of plot in Column (f))}} \times 100 = \text{percent composition}$$

Illustration 7

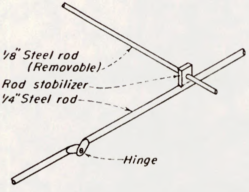
RANGELAND MONITORING - TREND STUDIES

PLOT FRAME - 3- X 3-FOOT


3'0" (Inside)
1'0"
1'0"
1'0"
1'0"
3'0" (Inside)
1'0"
1'0"
Hinge
Hinge
1/4" Round or square steel rod
1/8" Removable steel rods
Rod stabilizers (See Detail)



Gridded overlay frame for use with 3'x3' plot frame Each grid 1/16 sq. ft. (3"x3")



DETAIL

Illustration 8

RANGELAND MONITORING - TREND STUDIES

PLOT FRAME - 5- X 5-FOOT

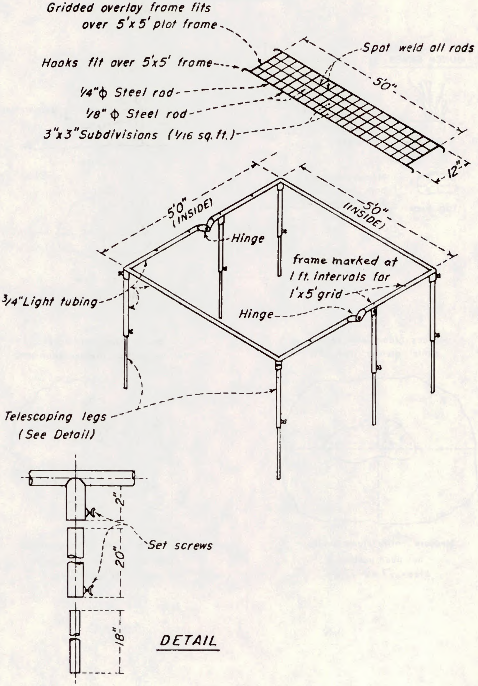
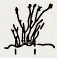

Gridded overlay frame fits over 5'x 5' plot frame
Spot weld all rods
Hooks fit over 5'x5' frame
5'0"
1/4" ϕ Steel rod
1/8" ϕ Steel rod
3"x3" Subdivisions (1/16 sq. ft.)
12"
5'0" (INSIDE)
5'0" (INSIDE)
Hinge
frame marked at 1 ft. intervals for 1'x5' grid
3/4" Light tubing
Hinge
Telescoping legs (See Detail)
2"
Set screws
20"
18"
DETAIL

Illustration 9

RANGELAND MONITORING - TREND STUDIES

DIAGRAMMATIC SKETCHES OF VEGETATION GROWTH FORMS AND MEASUREMENT TECHNIQUES

BUNCH GRASS



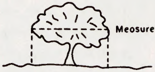
Side View

Measurement at one inch height

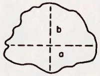
Top View

Measurement of both long and short diameters

SHRUB



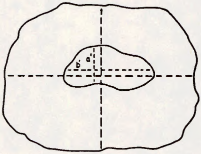
Side View



Top View

Area = πab

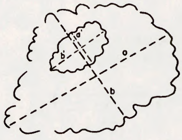
Grass Clump with dead center greater than 10%



Measure entire clump-Subtract out dead portion

Area = $\pi ab - \pi a'b'$

Brush crown with dead central portion greater than 10%



Measure entire crown area-Subtract out dead portion

Area = $\pi ab - \pi a'b'$

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TREND STUDY DATA
COMMUNITY STRUCTURE ANALYSIS METHOD - FOLIAR COVER DATA

STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE

COVER CATEGORY AND PLANT SPECIES	COVER CLASS 1 1-5 % (2.5)		COVER CLASS 2 5-25 % (15)		COVER CLASS 3 25-50 % (37.5)		COVER CLASS 4 50-75 % (62.5)		COVER CLASS 5 75-95 % (85)		COVER CLASS 6 95-100% (97.5)		PERCENT COVER
	DOT COUNT	#	DOT COUNT	#	DOT COUNT	#	DOT COUNT	#	DOT COUNT	#	DOT COUNT	#	
LITTER													
ROCK ≥ 1/2 INCH													

$$\text{Percent Cover by Species} = \frac{\sum\left[\begin{matrix}\text{(No. in)} & \text{(Midpoint)} \\ \text{(Class 1)} & \text{(Class 1)}\end{matrix} + \begin{matrix}\text{(No. in)} & \text{(Midpoint)} \\ \text{(Class 2)} & \text{(Class 2)}\end{matrix} + \ldots + \begin{matrix}\text{(No. in)} & \text{(Midpoint)} \\ \text{(Class 6)} & \text{(Class 6)}\end{matrix}\right]}{100}$$

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA
COMMUNITY STRUCTURE ANALYSIS METHOD - FOLIAR COVER DATA

STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE
CUBA #1	9/15/84	JOE BLUE	CUBA - 2431	SOUTH

COVER CATEGORY AND PLANT SPECIES	COVER CLASS 1 1-5 % (2.5)		COVER CLASS 2 5-25 % (15)		COVER CLASS 3 25-50 % (37.5)		COVER CLASS 4 50-75 % (62.5)		COVER CLASS 5 75-95 % (85)		COVER CLASS 6 95-100% (97.5)		PERCENT COVER
	DOT COUNT	#	DOT COUNT	#	DOT COUNT	#	DOT COUNT	#	DOT COUNT	#	DOT COUNT	#	
LITTER	⊠⊠□	28	⊠⊓	17	∵	3							4
ROCK ≥ 1/2 INCH	⧄	9	:	2			·	1					1
HIJA	⊠□	18	⊠⊠∵	23	⊠	10	:	2					9
SPAI	Γ.	6	∺	5									1
SIHY	⊠⊠Γ.	26	⊓	7	∵	3							3
BOGR2	⊠:	12	⊠⊓	17	∵	3	·	1					5
ASTRA	∵	3	Γ.	6	·	1							1
SPDI3	·	1	∷	4	:	2							1
EULA5	∺	5	⧄	9	·	1							2
GUSA2	⧄	9	:	2	∵	3							2
OPCL	:	2	∵	3			·	1					1
ATOB	∷	4	□	8	∺	5			·	1			4
											(100 Samples)		

Percent Cover by Species = $$\frac{\sum\left[(\text{No. in})(\text{Midpoint})_{(\text{Class 1})(\text{Class 1})} + (\text{No. in})(\text{Midpoint})_{(\text{Class 2})(\text{Class 2})} + \ldots + (\text{No. in})(\text{Midpoint})_{(\text{Class 6})(\text{Class 6})}\right]}{100}$$

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA
COMMUNITY STRUCTURE ANALYSIS METHOD - DENSITY AND FREQUENCY DATA

STUDY NUMBER

DATE

EXAMINER

ALLOTMENT NAME & NUMBER

PASTURE

PLANT SPECIES	PLOT NUMBER										DENSITY (TOTAL)	FREQUENCY (%)
	1	2	3	4	5	6	7	8	9	10		

Density = Total number of plants by species recorded for all ten plots.

$$\text{Frequency (\%)} = \frac{\text{No. of plots in which a species occurs}}{10} \times 100$$

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OR ANOTHER PAGE)

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TREND STUDY DATA
COMMUNITY STRUCTURE ANALYSIS METHOD - DENSITY AND FREQUENCY DATA

STUDY NUMBER CUBA # 1	DATE 9/15/84	EXAMINER JOE BLUE
ALLOTMENT NAME & NUMBER CUBA - 2431	PASTURE SOUTH	

PLANT SPECIES	PLOT NUMBER 1	2	3	4	5	6	7	8	9	10	DENSITY (TOTAL)	FREQUENCY (%)
HIJA	4	3	-	7	2	5	7	-	2	6	36	80
SPAI	1	-	3	-	4	-	-	1	2	-	11	50
SIHY	-	2	4	1	3	2	5	-	-	3	20	70
BOGR2	3	2	5	2	4	4	-	-	3	4	27	80
ASTRA	-	1	-	-	-	-	-	1	-	-	2	20
SPOI3	1	-	-	1	-	1	-	-	1	-	4	40
EULA5	2	4	5	-	-	2	-	6	-	-	19	50
GUSA2	-	-	-	-	1	5	3	4	2	-	15	50
OPCL	-	1	-	-	1	-	-	-	-	-	2	20
ATOB	-	-	-	-	-	-	-	1	-	-	1	10

Density = Total number of plants by species recorded for all ten plots.

Frequency (%) = $\frac{\text{No. of plots in which a species occurs}}{10} \times 100$

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TREND STUDY DATA
COMMUNITY STRUCTURE ANALYSIS METHOD - SUMMARY

STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE

PLANT SPECIES	FOLIAR COVER		DENSITY		FREQUENCY		IMPORTANCE VALUE
	%	RELATIVE	NUMBER	RELATIVE	%	RELATIVE	
TOTALS		1.00		1.00		1.00	3.00

PLANT COVER	LITTER	ROCK	BARE GROUND
%	%	%	%

CALCULATIONS

1. Plant Cover - Total percent cover for all species listed on the Foliar Cover Data Form. (This value may be $\geq$ 100%.)

2. Litter - Total percent litter cover recorded on the Foliar Cover Data Form.

3. Rock - Total percent rock cover recorded on the Foliar Cover Data Form.

4. Bare Ground - 100 percent minus plant cover, litter, and rock percentages equals percent bare ground. (Note: Percent bare ground calculated in this manner will be much lower than it actually is because overlapping canopies as well as litter and rock beneath plant canopies are subtracted from 100%.)

5. Plant Species - List all the species listed on the Foliar Cover Data and Density and Frequency Data Forms.

6. Foliar Cover
   - % - Enter the percent cover for each species listed on the Foliar Cover Data Form.
   - Relative - Divide each species' % cover by the total plant cover. The relative cover column will total 1.00.

7. Density
   - Number - Enter the number of plants for each species listed on the Density and Frequency Data Form.
   - Relstive - Divide the total number of plants for each species by the total number of plants for all species. The relative density column will total 1.00.

8. Frequency
   - % - Enter the % frequency for each species listed on the Density and Frequency Data Form.
   - Relative - Divide the % frequency for each species by the total frequency for all species. The relative frequency column will total 1.00.

9. Importance Value - Relative Cover + Relative Density + Relative Frequency = Importance Value by species. The importance value column will total 3.00.

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TREND STUDY DATA
COMMUNITY STRUCTURE ANALYSIS METHOD - SUMMARY

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STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE
CUBA # 1	9/15/84	JOE BLUE	CUBA - 2431	SOUTH

PLANT SPECIES	FOLIAR COVER %	FOLIAR COVER RELATIVE	DENSITY NUMBER	DENSITY RELATIVE	FREQUENCY %	FREQUENCY RELATIVE	IMPORTANCE VALUE
HIJA	9	.31	36	.26	80	.17	.74
SPAI	1	.03	11	.08	50	.11	.22
SIHY	3	.11	20	.15	70	.15	.41
BOGR2	5	.18	27	.20	80	.17	.55
ASTRA	1	.03	2	.01	20	.04	.08
SPOI3	1	.03	4	.03	40	.08	.14
EULA5	2	.07	19	.14	50	.11	.32
GUSA2	2	.07	15	.11	50	.11	.29
OPCL	1	.03	2	.01	20	.04	.08
ATOB	4	.14	1	.01	10	.02	.17
TOTALS	29	1.00	137	1.00	470	1.00	3.00

PLANT COVER	LITTER	ROCK	BARE GROUND
29 %	4 %	1 %	66 %

CALCULATIONS

1. Plant Cover - Total percent cover for all species listed on the Foliar Cover Data Form. (This value may be $\geq$ 100%.)
2. Litter - Total percent litter cover recorded on the Foliar Cover Data Form.
3. Rock - Total percent rock cover recorded on the Foliar Cover Data Form.
4. Bare Ground - 100 percent minus plant cover, litter, and rock percentages equals percent bare ground. (Note: Percent bare ground calculated in this manner will be much lower than it actually is because overlapping canopies as well as litter and rock beneath plant canopies are subtracted from 100%.)
5. Plant Species - List all the species listed on the Foliar Cover Data and Density and Frequency Data Forms.
6. Foliar Cover
   - % - Enter the percent cover for each species listed on the Foliar Cover Data Form.
   - Relative - Divide each species' % cover by the total plant cover. The relative cover column will total 1.00.
7. Density
   - Number - Enter the number of plants for each species listed on the Density and Frequency Data Form
   - Relative - Divide the total number of plants for each species by the total number of plants for all species. The relative density column will total 1.00.
8. Frequency
   - % - Enter the % frequency for each species listed on the Density and Frequency Data Form.
   - Relative - Divide the % frequency for each species by the total frequency for all species. The relative frequency column will total 1.00.
9. Importance Value - Relative Cover + Relative Density + Relative Frequency = Importance Value by species. The importance value column will total 3.00.

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

Illustration 13

RANGELAND MONITORING - TREND STUDIES

COMMUNITY STRUCTURE ANALYSIS METHOD TRANSECT LAYOUT

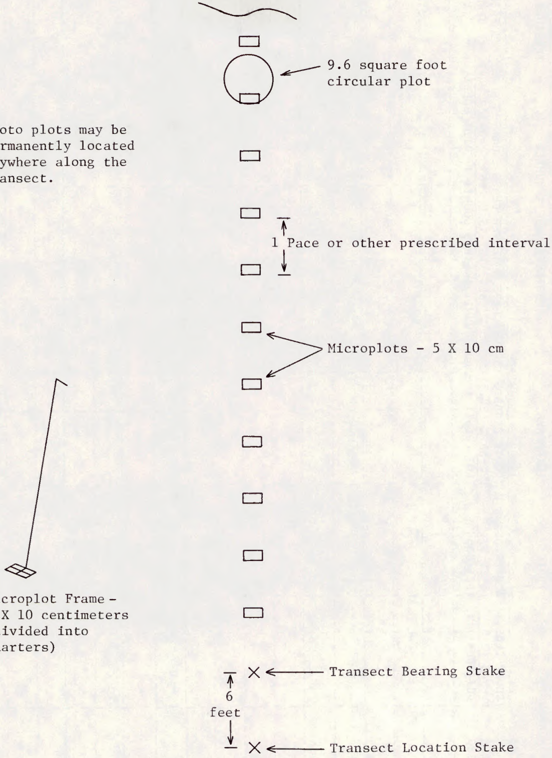

Photo plots may be permanently located anywhere along the transect.

Microplot Frame - 5 X 10 centimeters (divided into quarters)

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TREND STUDY DATA
DAUBENMIRE METHOD - SIX COVER CLASSES

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Page 1

STUDY NUMBER
DATE
EXAMINER
ALLOTMENT NAME & NUMBER
PASTURE

PLANT SPECIES	COVER CLASS 1 1-5 % (2.5)		COVER CLASS 2 5-25 % (15)		COVER CLASS 3 25-50 % (37.5)		COVER CLASS 4 50-75 % (62.5)		COVER CLASS 5 75-95 % (85)		COVER CLASS 6 95-100% (97.5)		FREQUENCY (%)	CANOPY COVERAGE (%)	SPECIES COMP. (%)
	DOT COUNT	#	DOT COUNT	#	DOT COUNT	#	DOT COUNT	#	DOT COUNT	#	DOT COUNT	#			

CALCULATION INSTRUCTIONS ON OTHER SIDE.

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

Illustration 14
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CALCULATION INSTRUCTIONS

$$\text{Frequency (\%)} = \frac{\text{Number of occurrences of a plant species}}{\text{Number of frames observed along the transect}} \times 100$$

$$\text{Canopy coverage (\%)} = \frac{\sum\left[\begin{matrix}(\text{No. in})\\(\text{Class 1})\end{matrix}\begin{matrix}(\text{Midpoint})\\(\text{Class 1})\end{matrix} + \begin{matrix}(\text{No. in})\\(\text{Class 2})\end{matrix}\begin{matrix}(\text{Midpoint})\\(\text{Class 2})\end{matrix} + \ldots + \begin{matrix}(\text{No. in})\\(\text{Class 6})\end{matrix}\begin{matrix}(\text{Midpoint})\\(\text{Class 6})\end{matrix}\right]}{\text{Number of frames observed along the transect}}$$

$$\text{Species composition (\%)} = \frac{\text{\% canopy coverage by species}}{\text{Total canopy coverage}}$$

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TREND STUDY DATA
DAUBENMIRE METHOD - SIX COVER CLASSES

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STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE
035-27W-08-03	7/24/84	CHARLIE WAGON	QUAKING ASPEN-1037	SHEEP CREEK

PLANT SPECIES	COVER CLASS 1 1-5 % (2.5) DOT COUNT	#	COVER CLASS 2 5-25 % (15) DOT COUNT	#	COVER CLASS 3 25-50 % (37.5) DOT COUNT	#	COVER CLASS 4 50-75 % (62.5) DOT COUNT	#	COVER CLASS 5 75-95 % (85) DOT COUNT	#	COVER CLASS 6 95-100% (97.5) DOT COUNT	#	FREQUENCY (%)	CANOPY COVERAGE (%)	SPECIES COMP. (%)
AGSP	⊠	10	⁙	5	:	2	·	1					36	5	16
PONE3	⁙	5	⁖	3	:	2	·	1					22	4	13
ORHY	:	2			·	1							6	1	3
STTH2	⁖	3	·	1	:	2							12	2	6
SIHY	:	2											4	–	–
BRTE	Γ:	6	·	1									14	1	3
PHHO	∷	4	:	2									12	1	3
CRAC2	⁖	3											6	–	–
ASTER	⁖	3	:	2									10	1	3
ARTR2	·	1	:	2	:	2	Γ:	6					22	10	31
CHVI8			:	2	⁖	3	:	2	·	1			16	7	22
														32	100

(50 Samples)

CALCULATION INSTRUCTIONS ON OTHER SIDE.

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA
DAUBENMIRE METHOD - TEN COVER CLASSES

STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE

COVER CLASS	1 (2.5)		2 (8.75)		3 (18.75)		4 (31.25)		5 (43.75)		6 (56.25)		7 (68.75)		8 (81.25)		9 (91.25)		10 (97.5)			CAN	SPEC
	0-5 %		5-12.5 %		12.5-25 %		25-37.5 %		37.5-50 %		50-62.5 %		62.5-75 %		75-87.5 %		87.5-95 %		95-100 %		FREQ	COV	COMP
SPECIES	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	(%)	(%)	(%)

CALCULATION INSTRUCTIONS ON OTHER SIDE.

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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Illustration 15
Page 2

CALCULATION INSTRUCTIONS

$$\text{Frequency (\%)} = \frac{\text{Number of occurrences of a plant species}}{\text{Number of frames observed along the transect}} \times 100$$

$$\text{Canopy coverage (\%)} = \frac{\sum \left[\left(\begin{matrix}\text{No. in}\\ \text{Class 1}\end{matrix}\right)\left(\begin{matrix}\text{Midpoint}\\ \text{Class 1}\end{matrix}\right) + \left(\begin{matrix}\text{No. in}\\ \text{Class 2}\end{matrix}\right)\left(\begin{matrix}\text{Midpoint}\\ \text{Class 2}\end{matrix}\right) + \ldots + \left(\begin{matrix}\text{No. in}\\ \text{Class 10}\end{matrix}\right)\left(\begin{matrix}\text{Midpoint}\\ \text{Class 10}\end{matrix}\right) \right]}{\text{Number of frames observed along the transect}}$$

$$\text{Species composition (\%)} = \frac{\text{\% canopy coverage by species}}{\text{Total canopy coverage}}$$

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TREND STUDY DATA
DAUBENMIRE METHOD - TEN COVER CLASSES

STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE
17N-38W-23-01	7/19/84	BILLY BLOW	HAWKTHORN - 0028	

COVER CLASS	1 (2.5) 0-5 %		2 (8.75) 5-12.5 %		3 (18.75) 12.5-25 %		4 (31.25) 25-37.5 %		5 (43.75) 37.5-50 %		6 (56.25) 50-62.5 %		7 (68.75) 62.5-75 %		8 (81.25) 75-87.5 %		9 (91.25) 87.5-95 %		10 (97.5) 95-100 %		FREQ (%)	CAN COV (%)	SPEC COMP (%)
SPECIES	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#	DOT CT	#			
FEIO	∴	3	☒·	11	∺	5	∴	3	∺	5	:	2									58	12	32
SIHY	:	2	·	1	·	1	·	1													10	1	3
AGSP	:	2	:	2	∺	5	:	2													22	4	11
BRTE	☒	10	:	2																	24	1	3
AGSA2	∴	3	·	1	·	1															10	1	3
BASA3	:	2	:	2	☐	8															24	3	8
DELPH	·	1	·	1	∴	3															10	1	3
PHHO	:	2	∴	3																	10	1	3
ANTEN	∴	3	·	1			·	1													10	1	3
ERIOG	:	2	∺	5	·	1	·	1													18	2	5
ARTR2					∺	5	·	1	:	2	·	1									18	5	13
CHVI8	·	1	∷	4	∴	3	·	1			·	1	·	1							22	5	13
															(50 Samples)							37	100

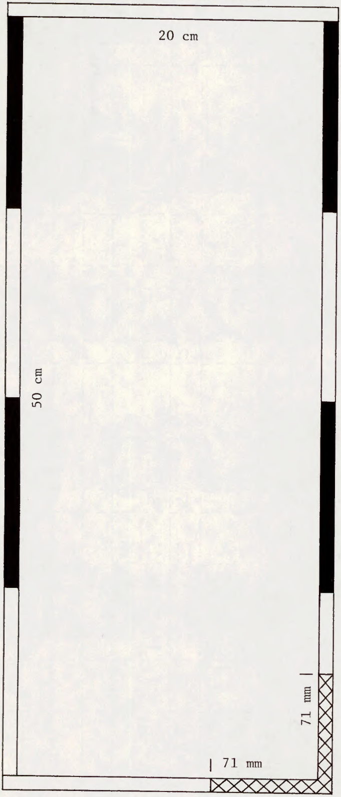
CALCULATION INSTRUCTIONS ON OTHER SIDE.

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

RANGELAND MONITORING - TREND STUDIES

DAUBENMIRE METHOD 20- X 50-cm FRAME

Six Cover Class Frame



The frame is made of 3/8 inch iron rod. The inside dimensions of the frame are 20 X 50 centimeters. The frame should have sharpened legs 3 centimeters long welded to each corner to help hold the frame in place.

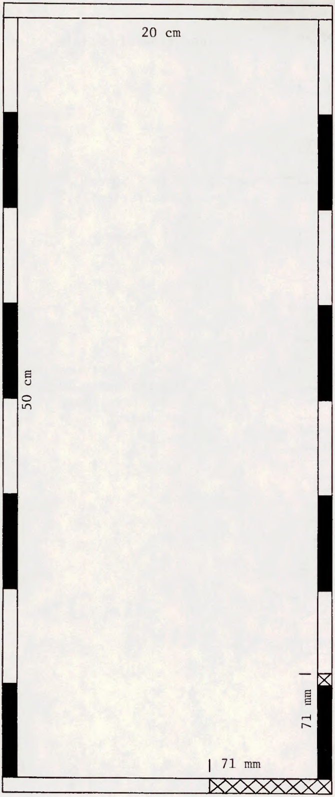
The six cover class frame is divided into fourths by painting alternate sections of the frame different colors as illustrated. Use orange and white or red and white paint.

In one corner of the frame, delineate two sides of an area 71 millimeters square as illustrated. This area represents 5% of the plot area.

The painted design provides visual reference areas equal to 5, 25, 50, 75, 95 and 100% of the plot area.

RANGELAND MONITORING - TREND STUDIES

Ten Cover Class Frame



The frame is made of 3/8 inch iron rod. The inside dimensions of the frame are 20 X 50 centimeters. The frame should have sharpened legs 3 centimeters long welded to each corner to help hold the frame in place.

The ten cover class frame is divided into eights by painting alternate sections of the frame different colors as illustrated. Use orange and white or red and white paint.

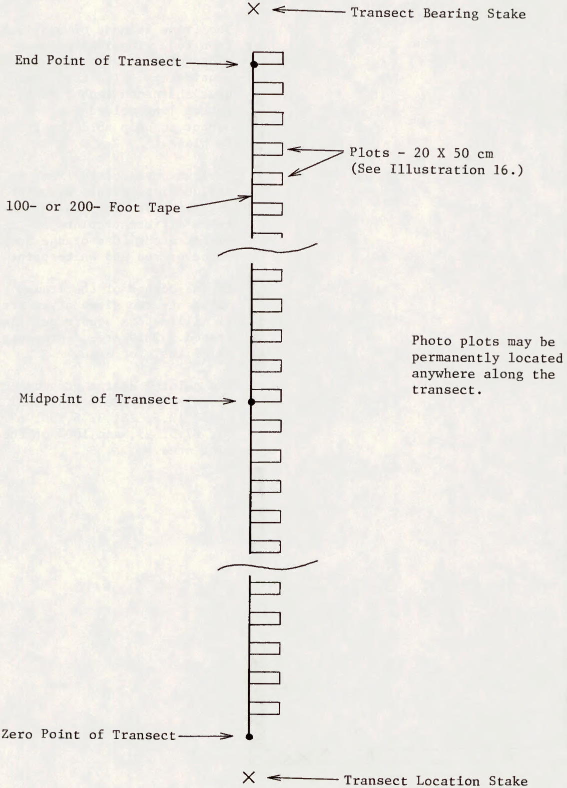
In one corner of the frame, delineate two sites of an area 71 millimeters square as illustrated. This area represents 5% of the plot area.

The painted design provides visual reference areas equal to 5, 12.5, 25, 37.5, 50, 62.5, 75, 87.5, 95, and 100% of the plot area.

Illustration 17

RANGELAND MONITORING - TREND STUDIES

DAUBENMIRE METHOD TRANSECT LAYOUT



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TREND STUDY DATA
PACE FREQUENCY METHOD

STUDY NUMBER	DATE	EXAMINER

ALLOTMENT NAME & NUMBER	PASTURE

COVER CATEGORY	TRANSECT 1	TRANSECT 2	TRANSECT 3	TRANSECT 4	TOTALS	COV %
BARE GROUND						
PERSIST LITTER						
NON-PER LITTER						
ROCK (≥1/2 INCH)						
LIVE VEG (BASAL)						
COVER TOTALS						100%

PLANT SPECIES	FREQUENCY				TOTALS	FREQ %

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA
PACE FREQUENCY METHOD

STUDY NUMBER	DATE	EXAMINER
13S-07E-35-04	7/23/84	BILLY BORDER

ALLOTMENT NAME & NUMBER	PASTURE
GUMBO HILLS - 1270	DRY CREEK

COVER CATEGORY	TRANSECT 1	TRANSECT 2	TRANSECT 3	TRANSECT 4	TOTALS	COV %
BARE GROUND	⊓	⊠∵	⊠⊠Γ.	⊠⊠:	68	34
PERSIST LITTER	:	∺	∵		10	5
NON-PER LITTER	⊠⊠:	⊠⊓	⊠∵	⊠⊠	72	36
ROCK (≥1/2 INCH)	⧄	⊓	∵	·	20	10
LIVE VEG (BASAL)	⊠	□	∺	⊓	30	15
COVER TOTALS	50	50	50	50	200	100%

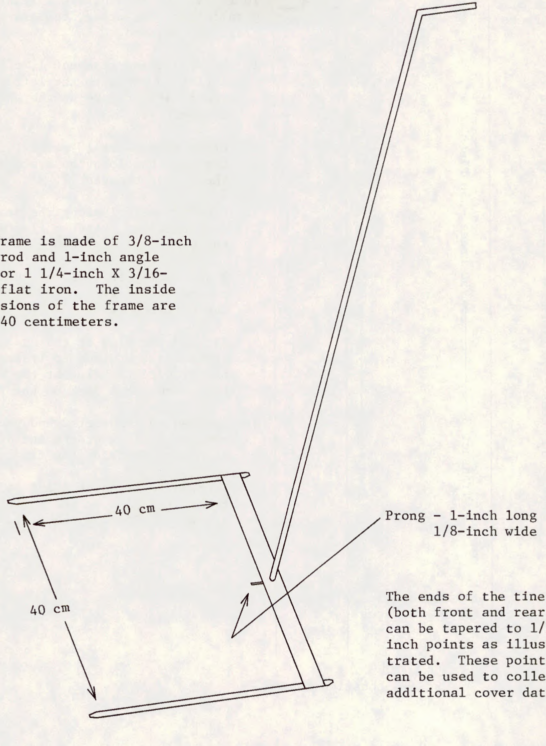
PLANT SPECIES	FREQUENCY				TOTALS	FREQ %
AGSP	⊠⊠∺	⊠⧄	⊠⊠⊠∵	⊠⊠⊠⊓	114	57
KOCR	⊠⊠·	⊠⊠⊠∵	⊠⊓	⊠⊠⧄	100	50
PONE3	⊠⊠⊠⊠	⊠⊠⊠∷	⊠⊠⊠:	⊠⊠Γ.	132	66
STVI4	⊠	⊓	□	∺	30	15
PHLO2	∺	∵	:	⧄	19	10
ASTER	□	∵	·		12	6
PENST	·	Γ.	⧄	:	18	9
GUSA2	∵	∺		·	9	5
CHNA2		:		·	3	2
ARTR2	⊓	∵	⊠:	·	23	12
				(200 Samples)		

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

RANGELAND MONITORING - TREND STUDIES

PACE FREQUENCY METHOD PLOT FRAME

The frame is made of 3/8-inch iron rod and 1-inch angle iron or 1 1/4-inch X 3/16-inch flat iron. The inside dimensions of the frame are 40 X 40 centimeters.

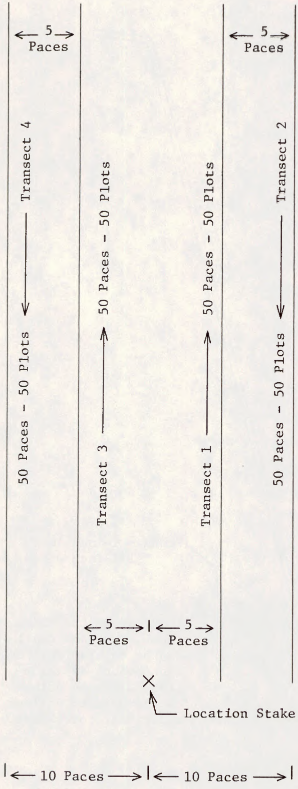


The ends of the tines (both front and rear) can be tapered to 1/8-inch points as illustrated. These points can be used to collect additional cover data.

Illustration 20

RANGELAND MONITORING - TREND STUDIES

PACE FREQUENCY METHOD STUDY LAYOUT



To facilitate running the 4 transects parallel to each other, temporary flags may be used.

1. Before pacing transect 1, place a flag 10 paces to the left of the location stake at the end of transect 4.
2. Place a 2nd flag 10 paces to the right of the location stake at the end of transect 2.
3. Pace transect 1 along the transect bearing. Place a flag at the end of this transect.
4. Place a flag 10 paces to the left of the end of transect 1 at the end of transect 3.
5. Pick up the flag at the end of Transect 1, proceed to Transect 2, pace toward the flag at the end of that transect. Pick up the flag.
6. Proceed to transect 3 and pace toward the flag at the end of that transect. Pick up the flag.
7. Proceed to transect 4 and pace toward the flag at the end of the transect. Pick up the flag.

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TREND STUDY DATA
QUADRAT FREQUENCY METHOD

STUDY NUMBER	DATE	EXAMINER

ALLOTMENT NAME & NUMBER	PASTURE

COVER CATEGORY	TR 1	TR 2	TR 3	TR 4	TR 5	TR 6	TR 7	TR 8	TR 9	TR 10	TOTALS	COV %
BARE GROUND												
PERSIST LITTER												
NON-PER LITTER												
ROCK (≥1/2 INCH)												
LIVE VEG (BASAL)												
COVER TOTALS												100%

PLANT SPECIES	FR	FREQUENCY										TOTALS	FREQ %

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA
QUADRAT FREQUENCY METHOD

STUDY NUMBER: (C-16-7) 19 Acb - 2
DATE: 9/12/84
EXAMINER: B.J. EASY
ALLOTMENT NAME & NUMBER: VERDE - 0513
PASTURE: (3 cover readings with each placement of the frame)

COVER CATEGORY	TR 1	TR 2	TR 3	TR 4	TR 5	TR 6	TR 7	TR 8	TR 9	TR 10	TOTALS	COV %
BARE GROUND	Π	∺	Γ·	:	⧄	□	∴	⊠·	∷	□	63	21
PERSIST LITTER	∴	:	∺	·		·	∴		·	⊠	26	9
NON-PER LITTER	Π	□	⊠	⊠⧄	⊠∺	⊠∷	⊠	∷	⊠	∺	102	34
ROCK (≥1/2 INCH)	⊠	⊠:	Γ·	∴	∷	:	Γ·	∺	⊠·	:	61	20
LIVE VEG (BASAL)	∴	∴	∴	∺	:	∺	□	⊠	∷	∺	48	16
COVER TOTALS	30	30	30	30	30	30	30	30	30	30	300	100%

PLANT SPECIES	FR	TR 1	TR 2	TR 3	TR 4	TR 5	TR 6	TR 7	TR 8	TR 9	TR 10	TOTALS	FREQ %
		FREQUENCY											
BOCU	12 in.	∴	∺	Π	·	∺	∴	Π	∷		Γ·	41	41
BOHI2	"	Π	∺	Π	⊠	:	⧄	⊠	∺	□	Π	70	70
SIHY	"	·	∷	:		:		·		Γ·	:	18	18
BOGR2	3 in.	⊠	Π	∷	∴	Γ·	∺	∴	Π	Π	⧄	61	61
HYRI	12 in.		·	∺	:	·	Γ·	·	:	·		19	19
ERIOG	"	·			:	∴		:				8	8
AMPS	"	·		:								3	3
PSORA	"		·									1	1
VIGUI	"	:	∺	·	:	∴		·	Π	·		22	22
OPUNT	"		·	:							·	4	4
JUNIP	"		:									2	2
NOMI	"			:					·			3	3
		(10 Quadrats - 10 Transects = 100 Samples)											

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

RANGELAND MONITORING - TREND STUDIES

QUADRAT FREQUENCY METHOD FRAMES

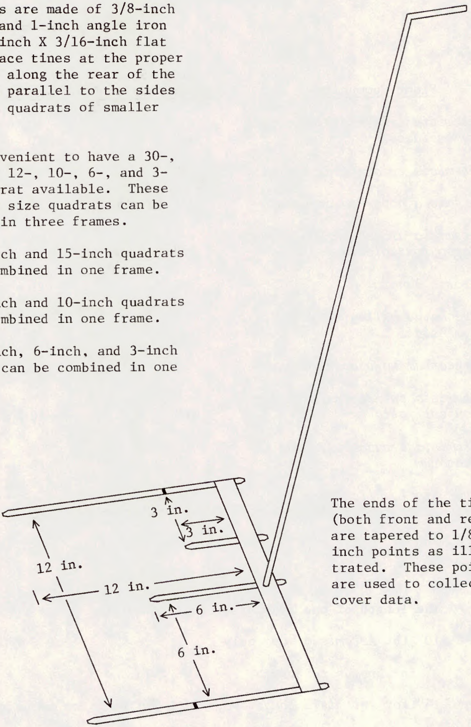
The frames are made of 3/8-inch iron rod and 1-inch angle iron or 1 1/4-inch X 3/16-inch flat iron. Place tines at the proper intervals along the rear of the frame and parallel to the sides to create quadrats of smaller sizes.

It is convenient to have a 30-, 20-, 15-, 12-, 10-, 6-, and 3-inch quadrat available. These different size quadrats can be combined in three frames.

The 30-inch and 15-inch quadrats can be combined in one frame.

The 20-inch and 10-inch quadrats can be combined in one frame.

The 12-inch, 6-inch, and 3-inch quadrats can be combined in one frame.



The ends of the tines (both front and rear) are tapered to 1/8-inch points as illustrated. These points are used to collect cover data.

RANGELAND MONITORING - TREND STUDIES

RECOMMENDED QUADRAT FRAME SIZES, NUMBER OF TRANSECTS, AND NUMBER OF QUADRATS PER TRANSECT FOR SEVERAL RANGELAND PLANT COMMUNITIES IN NEVADA (Tueller et. al. 1972).

Plant Community	Frame Size Recommendation*	Recommended Number of Transects and Quadrats: No. of Transects	No. of Quadrats
1. *Artemisia tridentata/Oryzopsis hymenoides*	30"	20	20
2. *Artemisia tridentata/* (Seral)	16"	10	20
3. *Artemisia nova/Poa secunda*	20"(10")**	20	10
4. *Artemisia arbuscula/Poa secunda/Agropyron spicatum*	10"	20	10
5. *Eurotia lanata*	3"	20	10
6. *Sarcobatus baileyi/Oryzopsis hymenoides*	12"	20	10
7. *Chrysothamnus viscidiflorus*	6"	20	10
8. *Artemisia spinescens/Atriplex confertifolia*	10"	20	10
9. *Artemisia arbuscula/Bromus tectorum*	24"(3")***	20	10
10. *Artemisia longiloba/Poa secunda/Festuca idahoensis*	24" or 30"(15")****	20	20

* The length of one side of a square quadrat

** 10" for *Artemisia nova* only

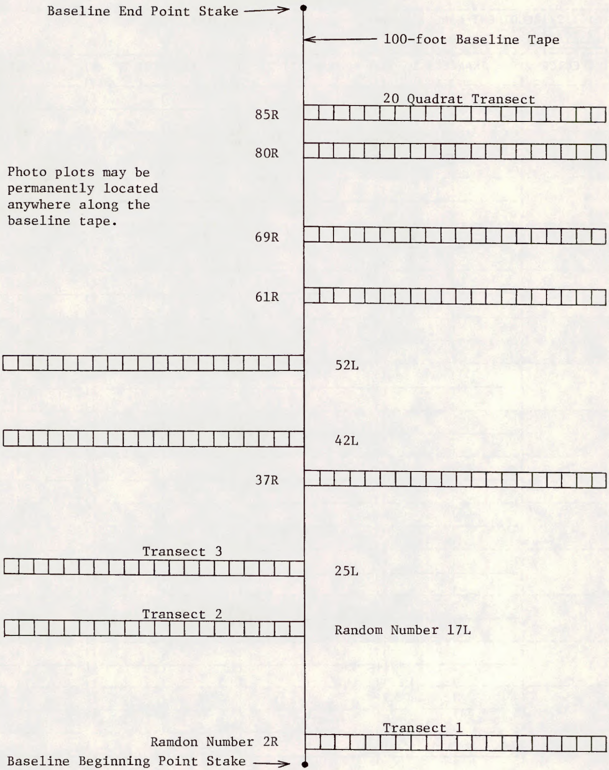
*** 3" for *Bromus tectorum*

**** 15" for *Artemisia longiloba, Phlox diffusa, Poa secunda*

Illustration 24

RANGELAND MONITORING - TREND STUDIES

QUADRAT FREQUENCY METHOD STUDY LAYOUT



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TREND STUDY DATA
NESTED FREQUENCY METHOD - FOUR TRANSECTS

STUDY NUMBER	DATE	EXAMINER

FRAME SIZES		ALLOTMENT NAME & NUMBER	PASTURE
1	2		
4	3		

PLANT SPECIES	TRANSECT 1		TRANSECT 2		TRANSECT 3		TRANSECT 4	

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA
NESTED FREQUENCY METHOD - FOUR TRANSECTS

STUDY NUMBER: Cow Creek #3
DATE: 7/31/84
EXAMINER: Betsy Trees

FRAME	1	2
SIZES	4	3

ALLOTMENT NAME & NUMBER: Cow Creek - 0438
PASTURE: Little Calf

PLANT SPECIES	TRANSECT 1		TRANSECT 2		TRANSECT 3		TRANSECT 4	
	∴	∷		Γ.	⊓	∷	⧄	⊓
AGSP	⊓	⊠·	:	⊠·	⊠∴	⧄	⊠·	⊠
	:	:	⊠	⊓	:	⊠	∷	⧄
KOCR	·	⊠Γ.	☐	☐	‾‥		⊠:	∷
	Γ.	⊠:	Γ.	☐	:	⊠:	☐	Γ.
PONE3	:	⊠⊠	⊠	⊠	⧄	⧄	‾‥	⊓
	·	∷		:			·	:
STVI4	∷	·	·	∷	☐			:
			·	·			·	
PHLO2		‾‥	·		:		·	⊓
	·	∴						
ASTER	∷			∴	·			
				∷	·	:		:
PENST		·	:		∷	:		
								·
GUSA2	:	·	·	∷				
CHNA2			:				·	
					·	‾‥		
ARTR2	∷	∴	∴		∷	:	·	
					(200 Samples)			

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA
NESTED FREQUENCY METHOD - FOUR TRANSECT SUMMARY

STUDY NUMBER	DATE	EXAMINER

FRAME SIZES			ALLOTMENT NAME & NUMBER	PASTURE
	1	2		
	4	3		

PLANT SPECIES	TRANSECT 1		TRANSECT 2		TRANSECT 3		TRANSECT 4		TOTALS		FREQUENCY(%)	

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA
NESTED FREQUENCY METHOD - FOUR TRANSECT SUMMARY

STUDY NUMBER: Cow Creek # 3
DATE: 7/31/84
EXAMINER: Betsy Trees

FRAME	1	2
SIZES	4	3

ALLOTMENT NAME & NUMBER: Cow Creek - 0438
PASTURE: Little Calf

PLANT SPECIES	TRANSECT 1		TRANSECT 2		TRANSECT 3		TRANSECT 4		TOTALS		FREQUENCY(%)	
AGSP	3	7	0	6	7	11	9	16	19	40	10	20
	25	18	19	17	33	20	37	26	114	81	57	41
KOCR	2	4	10	17	2	12	4	13	18	46	9	23
	21	20	33	25	17	12	29	17	100	74	50	37
PONE3	6	18	6	14	2	14	8	14	22	60	11	30
	40	38	34	24	32	23	26	21	132	106	66	53
STVI4	1	5	0	2	0	0	1	3	2	10	1	5
	10	6	7	6	8	0	5	5	30	17	15	9
PHLO2	0	0	1	2	0	0	1	1	2	3	1	2
	5	5	3	2	2	0	9	8	19	15	10	8
ASTER	1	4	0	0	0	0			1	4	1	2
	8	4	3	3	1	0			12	7	6	4
PENST	0	0	0	4	1	3	0	2	1	9	1	5
	1	1	6	4	9	5	2	2	18	12	9	6
GUSA2	0	0	0	0			0	1	0	1	0	1
	3	1	5	4			1	1	9	6	5	3
CHNA2			0	0			0	0	0	0	0	0
			2	0			1	0	3	0	2	0
ARTR2	0	0	0	0	1	6	0	0	1	6	1	3
	7	3	3	0	12	8	1	0	23	11	12	6

(200 Samples)

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA
NESTED FREQUENCY METHOD - TEN TRANSECTS

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FRAME SIZES 1 | 2 4 | 3	STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE

PLANT SPECIES	TRANS 1	TRANS 2	TRANS 3	TRANS 4	TRANS 5	TRANS 6	TRANS 7	TRANS 8	TRANS 9	TRANS 10

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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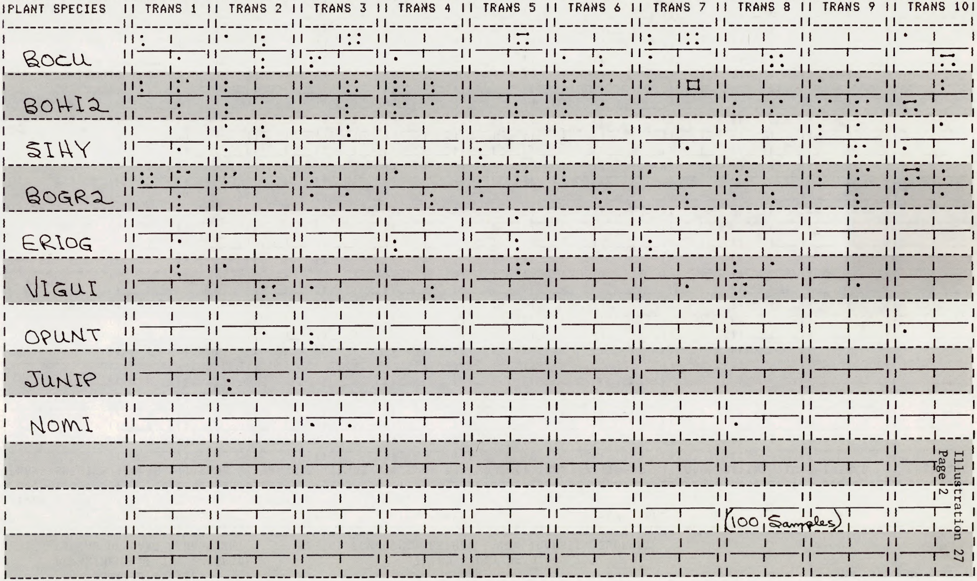
TREND STUDY DATA
NESTED FREQUENCY METHOD - TEN TRANSECTS

PAGE 1 OF 1

FRAME	1	2
SIZES	4	3

STUDY NUMBER: 02N-02W-15-1
DATE: 8/3/84
EXAMINER: JAKE ORB
ALLOTMENT NAME & NUMBER: WILD PLUM - 1117
PASTURE:



PLANT SPECIES	TRANS 1	TRANS 2	TRANS 3	TRANS 4	TRANS 5	TRANS 6	TRANS 7	TRANS 8	TRANS 9	TRANS 10
BOCU										
BOHI2										
SIHY										
BOGR2										
ERIOG										
VIGUI										
OPUNT										
JUNIP										
NOMI										

(100 Samples)

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA
NESTED FREQUENCY METHOD - TEN TRANSECT SUMMARY

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FRAME SIZES	1 2 4 3	STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE

PLANT SPECIES	TRANS 1	TRANS 2	TRANS 3	TRANS 4	TRANS 5	TRANS 6	TRANS 7	TRANS 8	TRANS 9	TRAN 10	TOTALS	FREQ(%)

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA
NESTED FREQUENCY METHOD - TEN TRANSECT SUMMARY

FRAME SIZES: 1 2 / 4 3
STUDY NUMBER: 02N-02W-15-1
DATE: 8/3/84
EXAMINER: JAKE ORB
ALLOTMENT NAME & NUMBER: WILD PLUM - 1117
PASTURE:

PLANT SPECIES	TRANS 1	TRANS 2	TRANS 3	TRANS 4	TRANS 5	TRANS 6	TRANS 7	TRANS 8	TRANS 9	TRAN 10	TOTALS	FREQ(%)
BOCU	2 2	1 3	0 4	0 0	0 5	0 0	2 6	0 0		1 1	6 21	6 21
	3 3	5 5	7 4	1 0	5 5	3 2	7 6	4 4		6 6	41 35	41 35
BOHI2	2 5	2 2	1 5	4 6	0 0	3 6	2 10	0 0	1 2	0 2	15 38	15 38
	7 7	5 3	7 7	10 7	2 2	9 7	10 10	5 3	8 5	7 2	70 53	70 53
SIHY	0 0	1 3	0 2		0 0		0 0		2 3	0 1	3 9	3 9
	1 1	4 3	2 2		2 0		1 1		6 6	2 1	18 14	18 14
BOGR2	4 7	3 7	2 2	1 1	2 5	2 2	1 1	4 4	2 5	5 7	26 41	26 41
	9 9	7 7	4 3	3 3	6 5	5 5	3 3	7 6	7 7	9 8	60 56	60 56
ERIOG	0 0			0 0	0 1		0 0				0 1	0 1
	1 1			2 0	3 3		2 0				8 4	8 4
VIGUI	0 2	1 1	0 0	0 0	0 3		0 0	2 3	0 0		3 9	3 9
	2 2	5 5	1 0	2 2	3 3		1 1	7 3	1 1		22 17	22 17
OPUNT		0 0	0 0							0 0	0 0	0 0
		1 1	2 0							1 0	4 1	4 1
JUNIP		0 0									0 0	0 0
		2 0									2 0	2 0
NOMI			0 0					0 0			0 0	0 0
			2 1					1 0			3 1	3 1

(100 Samples)

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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Illustration 28
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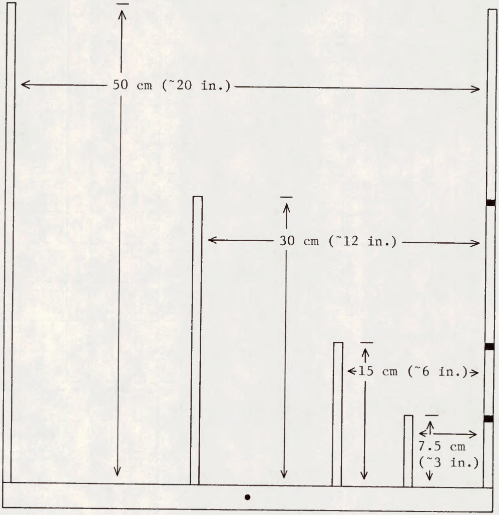
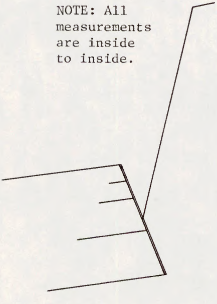
Illustration 29
Page 1

RANGELAND MONITORING - TREND STUDIES

NESTED FREQUENCY METHOD PLOT FRAMES



NOTE: All measurements are inside to inside.

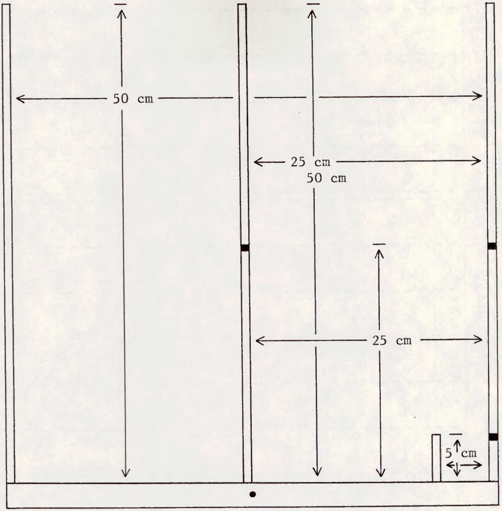


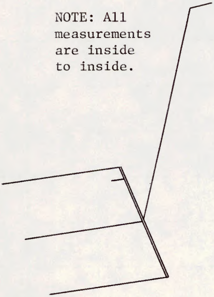
The frame is made of 3/8-inch iron rod and 1-inch angle iron or 1 1/4-inch X 3/16-inch flat iron. Place tines at the proper intervals along the rear of the frame and parallel to the sides to create the nested plot frame.

PLOT		
number	size	area
1	7.5 X 7.5 cm	56.25 sq cm
2	15.0 X 15.0 cm	225.00 sq cm
3	30.0 X 30.0 cm	900.00 sq cm
4	50.0 X 50.0 cm	2500.00 sq cm

Illustration 29
Page 2

RANGELAND MONITORING - TREND STUDIES





NOTE: All measurements are inside to inside.

The frame is made of 3/8-inch iron rod and 1-inch angle iron or 1 1/4-inch X 3/16-inch flat iron. Place tines at the proper intervals along the rear of the frame and parallel to the sides to create the nested plot frame.

PLOT number	size	area
1	5 X 5 cm	25 sq cm
2	25 X 25 cm	625 sq cm
3	25 X 50 cm	1250 sq cm
4	50 X 50 cm	2500 sq cm

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TREND STUDY DATA
LINE INTERCEPT METHOD

STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE

NOTES (Use other side or another page, if necessary)	GRASS SPECIES							FORB SPECIES						SHRUB SPECIES					NOTES
																			TOTALS
TOTALS																			
% COVER																			
% COMP.																			100%

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TREND STUDY DATA
LINE INTERCEPT METHOD

PAGE 1 OF 1

STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE
12N-37W-19-03	10/3/84	JACK STRAW	COW GULCH - 0111	

NOTES (Use other side or another page, if necessary)	GRASS SPECIES							FORB SPECIES						SHRUB SPECIES					NOTES
	BOCU	BOGR2	BOHI2	KOCR	SIHY			HYRI	PSORA	COWR2				CEGR	JUNIP				
	.42	.10	.32	.11	.06			.52	2.04	.55				3.40	.06				
	.20	.02	.25	.02	.02			.46	1.32	.22				.13	2.13				
100ft.	.26	.03	.05	.12	.02			1.47	.59					4.90	.07				
tape	.03	.01		.08	.04			.28	3.30					.72	.02				
	.17	.10			.05			.80	.07					.14					
	.26	.29			.26			.05						1.02					
	.22	.24			.04														
	.22	.14			.03														
	.34	.10			.01														
	.32	.17			.19														
	.02	.12			.02														
	.02	.18			.35														
	.10	.13																	
	.02	.14																	
	.16	.04																	
	.18	.16																	
	.10	.05																	
	.14	.27																	
	.06	.03																	
	.03	.46																	
	.04	.07																	
	.10	.38																	
	.02	.12																	
	.03	.10																	
	.02	.11																	
	.16	.03																	
		.36																	
		.68																	
																			TOTALS
TOTALS	3.64	4.63	.62	.33	1.09			3.58	7.32	.77				10.31	2.28				34.57
% COVER	4	5	1	0	1			4	7	1				10	2				35
% COMP.	11	14	3	-	3			11	20	3				29	6				100%

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Illustration 31
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TREND STUDY DATA
STEP-POINT TRANSECT METHOD

STUDY NUMBER	DATE	EXAMINER

ALLOTMENT NAME & NUMBER	PASTURE

GROUND-LEVEL COVER

CATEGORY	B BARE GROUND	P PERSIST LITTER	N NON-PERSIST LITTER	G GRAVEL (2MM–3")	C COBBLE (>3"–10")	S STONE (>10")	R BEDROCK
DOT COUNT							
TOTAL HITS							

BASAL AND FOLIAR COVER

BSL OR GRND-LEV	FOLIAR-LEVEL 1	FOLIAR-LEVEL 2	FOLIAR-LEVEL 3	DOT COUNT	TOTAL HITS

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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Illustration 31
Page 2

TREND STUDY DATA
STEP-POINT TRANSECT METHOD

STUDY NUMBER	DATE	EXAMINER
RED FEATHER #2	9/30/84	SUZIE BROWN

ALLOTMENT NAME & NUMBER	PASTURE
RED FEATHER - 1473	

GROUND-LEVEL COVER

CATEGORY	B BARE GROUND	P PERSIST LITTER	N NON-PERSIST LITTER	G GRAVEL (2MM–3")	C COBBLE (>3"–10")	S STONE (>10")	R BEDROCK
DOT COUNT	⧄	⁖	⊓	⊠	Γ.	:	
TOTAL HITS	9	5	7	10	6	2	—

BASAL AND FOLIAR COVER

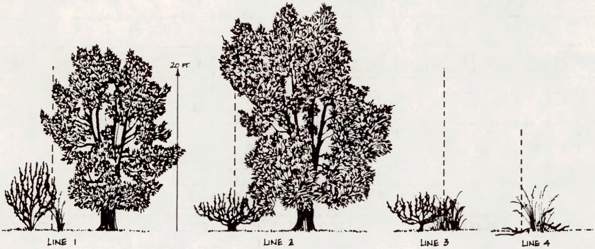
BSL OR GRND-LEV	FOLIAR-LEVEL 1	FOLIAR-LEVEL 2	FOLIAR-LEVEL 3	DOT COUNT	TOTAL HITS
N	BOCU			⊠ :	12
G	BOGR2	P	[JUNIP]	.	1
BOGR2	JUNIP			⊠ ⊠	20
G	BOCU			: :	4
SIHY				:	2
N	ERIOG			:	2
G	SIHY	RHTR		:	2
B	VIGUI			:	2
G	N	VIGUI		: :	4
B	BOCU			:	2
BOGR2	BOCU			:	2
B	BOHI2			:.	3
N	BOGR2	BOCU		:	2
BOCU	P			:	2
OPUNT				.	1

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

Illustration 32

RANGELAND MONITORING - TREND STUDIES

DIAGRAMMATIC SKETCHES OF OBSERVATION POINTS (HITS) AND RECORDING PROCEDURE



The data from the above illustrated observation points (hits) are recorded on the STEP-POINT TRANSECT METHOD FORM as follows:

	BASAL AND FOLIAR C			
	BSL OR GRND-LEV	FOLIAR-LEVEL 1	FOLIAR-LEVEL 2	FOLIAR-LEVEL 3
Line 1 -	B	AGSP	PUTR2	PIED
Line 2 -	ARTR2	[PIED]		
Line 3 -	AGSP	CHNA2		
Line 4 -	P	AGSP		

NOTE - To count as a basal hit on live vegetation, the plant crown at a 1-inch height above the ground must occupy the notch.

- Dead vegetation in the canopy is counted as litter.

- Plant codes for vegetation foliar cover hits more than 20 feet above the ground level should be enclosed in brackets [ ].

RANGELAND MONITORING - TREND STUDIES

RECORDING DATA IN A SPATIAL FORMAT

Vegetation data collected with some trend study methods can be recorded in a spatial format. Under a spatial format, the field forms have a separate block in which to record the data by species for each study sample. The data is recorded plot by plot, or point by point, as it is collected along a transect. This plot, or point, specific data provides information concerning the distribution of plant species on the study site. Subsequent readings of studies may show changes in the distribution of those species. If new species are picked up in subsequent readings, perhaps the examiner may want to take a broader look at the study site.

It doesn't take much more time to record data in a spatial format than it does to record it in the conventional manner. Data recorded in a spatial format may provide for more meaningful analysis and interpretation in allotment, wildlife habitat area, herd management area, watershed area, or other designated management area evaluations.

Page 3 of this Illustration is an example of how frequency data collected with the Pace Frequency Method can be recorded in a spatial format.

Page 5 of this Illustration is an example of how frequency data collected with the Quadrat Frequency Method can be recorded in a spatial format.

Page 6 of this Illustration is an example of how frequency data collected with the Nested Frequency Method can be recorded in a spatial format.

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TREND STUDY DATA

STUDY METHOD- ____________________

STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE

PLANT SPECIES

SAMPLE NUMBER

0 10 20 30 40 50 60 70 80 90 100

TOTAL

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT	TREND STUDY DATA	STUDY METHOD- PACE FREQUENCY	PAGE 1 OF 1

STUDY NUMBER	DATE	EXAMINER	ALLOTMENT NAME & NUMBER	PASTURE
07N-04W-13-05	10/29/84	BILLY JOE	HIGH RIDGE - 0783	RIDGE TOP

PLANT SPECIES	SAMPLE NUMBER (0–100)	TOTAL
BOGR2		65
BOHI2		37
PAOB		6
BOCU		35
BRRU2		10
SIHY		29
KOCR		20
HIJA		1
HYRI		16
AMPS		12
PSORA		3
VIGUI		30
ERIOG		19
OPUNT		3
CEGR		4
MAMMI		2
RHTR		9
JUNIP		2
GUSA2		11
NOMI		1

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA

STUDY METHOD- ______________________

STUDY NUMBER
DATE
EXAMINER
ALLOTMENT NAME & NUMBER
PASTURE

	SAMPLE NUMBER																				OCCURR BY PLOT SIZE				
PLANT SPECIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	1	2	3	4	TOTAL

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA

STUDY METHOD- QUADRAT FREQUENCY

STUDY NUMBER (TRANSECT 17L): BLUE DOME #1
DATE: 8/25/84
EXAMINER: BUDDY CLUMP
ALLOTMENT NAME & NUMBER: BLUE DOME - 0313
PASTURE:

	S A M P L E										N U M B E R										OCCURR BY PLOT SIZE				
PLANT SPECIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	1	2	3	4	TOTAL
AGSM	X	X		X		X	X	X	X	X	X		X		X		X		X						13
KOCR			X			X		X			X		X	X						X					7
BRTE				X												X		X							3
SIHY			X				X				X			X				X							5
STCO4																X	X								2
ASTRA		X							X		X														3
SPCO			X	X		X									X	X									5
ERIOG								X												X					2
DELPH										X															1
ARLU					X		X					X								X					4
SOPE												X	X												2
GUSA2												X	X	X	X										4
CHVI8					X												X	X	X	X					5
ARNO2	X						X	X		X								X	X						6

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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TREND STUDY DATA

STUDY METHOD- NESTED FREQUENCY

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Page 6

STUDY NUMBER (TRANSECT 61R) (C-14-7)12Oca - 4

DATE 9/1/84

EXAMINER ABE BUCKWHEAT

ALLOTMENT NAME & NUMBER DEEP WELL - 1271

PASTURE

122

PLANT SPECIES	SAMPLE NUMBER																				OCCURR BY PLOT SIZE				TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	1	2	3	4	
POSE	1	2	2	2	2	2	2	2	1	2	2		2	2	2	1	3			2	3	16	17	17	
SIHY	2	2	4			3	2	3	1	2	4	2	3	3	2	3	2	2	4	3	1	9	15	18	
BRTE		2	4	3	1	1	2	1	2	3	2	2	1	2	2	2	1	2	1	1	7	16	18	19	
AAGG								4						3	4		1				1	1	2	4	
ASTRA			3		3																0	0	2	2	
ERIOG							4					4									0	0	0	2	
PHHO												4									0	0	0	1	
PHLO2	3			3					3			1	2			2	2	2			1	5	8	8	
PPFF						3				4					4						0	0	1	3	
ARTR2		2						4		2	4		3		3		4				0	2	4	7	
CHVI8	2					4	2								4						0	2	2	4	
SSSS			4									4									0	0	0	2	

NOTES (USE OTHER SIDE OR ANOTHER PAGE)

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